

PHYSICS ABSTRACTS

SECTION A
of
SCIENCE ABSTRACTS

SECTION A, PHYSICS
SECTION B, ELECTRICAL ENGINEERING

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RELATED SUBJECTS CONTAINED IN SECTION B (ELECTRICAL ENGINEERING ABSTRACTS)

Mechanical testing	Automatic control mechanisms	Cyclotrons
Non-destructive testing	Applied electrochemistry	Amplifiers
Industrial radiography	Photocells	Radio-wave propagation
Corrosion	Thermionic tubes	Mechanical engineering
Electrical and magnetic measure- ments and instruments	Cathode-ray tubes	Heat engines
Electronic relays and counters	X-ray tubes	Illumination
	Induction accelerators	Metallurgy

NOTE ON THE ARRANGEMENT OF ABSTRACTS

The Abstracts are classified by subject according to the Universal Decimal Classification, and arranged in order of their U.D.C. numbers, which are printed at the head of the Abstract on the right. Abstracts on any particular subject can be located by first consulting the abridged tables of the U.D.C. published with the January number, or the Annual Alphabetical Subject Index, and then referring to the appropriate U.D.C. number in the text. The main headings are listed above.

[Continued on page 3 of cover]

MATHEMATICS 51

517.5 : 534.11

1261. Phase characteristics of exponential functions. LUCKING, D. F. Letter in *Nature, Lond.*, **163**, 180 (Jan. 29, 1949).—The equation studied is expressed by $\dot{x}_2 = -kx_1$, where $x_2 = x(t_2)$, $x_1 = x(t_1)$, and $t_2 - t_1 = c$. Solutions in a general exponential form, or in the form of a series, are obtained which may represent a direct subsidence, a damped oscillation, a harmonic oscillation, or an unbounded oscillation, according to the particular value assigned to the function $\phi = kc$. Illustrative examples are given.

G. G.

517.9 : 517.63

1262. Modern operational calculus based on the two-sided Laplace integral. II. VAN DER POL, B. AND BREMMER, H. *Proc. K. Ned. Akad. Wet.*, **51** (No. 9) 1125–36 (1948) In *English*.—For I, see Abstr. 398 (1949). After a discussion of the use of the Dirac δ function in operational calculus, the solution of linear differential equations with constant and variable coefficients respectively is illustrated. Examples are given of relations involving Bessel, Legendre and hypergeometric functions which can be obtained by considering Laplace transforms of functions of e^t . Various identities relating to one or more functions and their transforms are derived, and examples are given of the treatment of functions defined by means of generating functions.

M. R. H.

517.92 : 518.5

1263. The application of the National accounting machine to the solution of first-order differential equations. CARTER, A. E. AND SADLER, D. H. *Quart. J. Mech. Appl. Math.*, **1**, 433–41 (Dec., 1948).—Milne's formula for approximate quadrature is used as the basis of a method for the solution of first-order differential equations on the National machine. The method, which is illustrated by a numerical example, enables the machine to form the required dependent variable without the necessity for conversion from a sum to an integral.

A.

518.12 : 517.912.2

1264. Assessment of errors in approximate solutions of differential equations. DUNCAN, W. J. *Quart. J. Mech. Appl. Math.*, **1**, 470–6 (Dec., 1948).—The term assessment is applied to any process which enables one to set rigid bounds to the error or to estimate its value. It is shown that upper and lower bounds can be assigned whenever the Green's function of the problem is one-signed; this is true in many important problems. Another method is applicable to step-by-step solutions of ordinary differential equations, linear or non-linear, and depends on using the "index" of the process of integration. Lastly, the error in a linear problem can be estimated when an approximation to the Green's function is known.

A.

518.2

1265. Table of $\int_0^\infty \frac{e^{-u^2}}{u+x} du$. GOODWIN, E. T. AND STATON, J. *Quart. J. Mech. Appl. Math.*, **1**, 319–26

(Sept., 1948).—The function is tabulated to 4 decimals for the range of argument $x = 0(0.02)2(0.05)3(0.1)10$. To facilitate interpolation for small x an auxiliary function $g(x) = f(x) + \log x$ is tabulated to 4 decimals for $x = 0(0.1)1$. An asymptotic expression is given for $x > 10$. Full details of the method of computation are given and an interesting application of the Euler transformation to the summation of asymptotic series is included.

A.

518.5 : 621.318.572 : 621.385.832

1266. A storage system for use with binary-digital computing machines. WILLIAMS, F. C. AND KILBURN, T. *Proc. Instn. Elect. Engrs, Pt. III*, **96**, 81–100 (March, 1949).—For abstract see 472 B (1949).

519.2 : 621.318.572 : 539.16.08

1267. Resolution of devices actuated by random events. KLEMENS, P. G. *Phil. Mag.*, **39**, 656–60 (Aug., 1948).—The devices investigated are such that an interval of time, τ_1 , must elapse after an event has occurred and been recorded, before a following event can be recorded; but if an event be lost, a time, τ_2 , must elapse before an event can again be recorded. An expression is derived for the number of events recorded in an interval of time and the theory is applied to a mechanical pulse recorder.

L. S. G.

519.21 : 539.16.08

1268. Statistical error in absorption experiments. ROSE, M. E. AND SHAPIRO, M. M. *Phys. Rev.*, **74**, 1853–64 (Dec. 15, 1948).—In certain exponential absorption experiments, notably measurements of cross-sections by transmission, it is important to achieve minimum statistical error in a limited time or to minimize the counting time required to measure the absorption coefficient with a preassigned accuracy. The conditions required to attain these ends, i.e. the geometry for optimum transmission, and the best apportionment of counting times among the incident and transmitted beams and background, have been investigated for a wide range of relative backgrounds (10^{-3} to 10^2), and for two geometries: I. Beam area fixed, absorber thickness alone varied. II. Beam area and absorber thickness both disposable parameters, while the total amount of absorber intercepting the beam remains fixed. In both cases incident flux density and background rate are assumed constant. The optimum transmissions are shown to be, in general, considerably smaller than those commonly used in absorption experiments. The following have also been determined: (a) minimum statistical error for a given total counting time; (b) statistical error and the best distribution of counting times for non-optimum geometry; and (c) sensitivity of the accuracy or total counting time to deviations from optimum transmission.

A.

519.21 : 621.317.35 : 533.6.013.22

Spectral analysis of an irregular function. See Abstr. 1353

519.241.1

1269. A general method of constructing correlation indices. FRÉCHET, M. *Proc. Math. Phys. Soc., Egypt*,

3, 13-20 (May, 1946) *In English*.—The conditions which an index of correlation should satisfy are discussed. A general form of index is defined in terms of "distances" between functions. The method of calculation in a special case is described and a numerical example given.

N. L. J.

519.251

1270. On the relations between certain criteria for the estimation of statistical parameters. LANDAU, H. G. *Univ. Pittsburgh Bull.*, 43 (No. 2) 143-50 (1947).—A study of the relations between the mean square error and Pitman's "closeness" criterion as applied to unbiased estimators.

N. L. J.

ASTRONOMY . ASTROPHYSICS . GEODESY 52

521.042 : 523.12 : 539.17

1271. On the relative abundance of the elements. ALPHER, R. A. AND HERMAN, R. C. *Phys. Rev.*, 74, 1737-42 (Dec. 15, 1948).—The theory of the neutron capture process for the formation of the elements has been reformulated, taking into account the radioactive decay of neutrons as well as the expansion of the universe. However, the calculations have been carried out for the case of a static universe. Satisfactory agreement between this theory and observed relative abundances has been obtained with the assumption that the density of matter was 5×10^{-9} g/cm³ at the start of the capture process. A.

521.06 : 523.77 : 535.33 : 523.87

A study of four solar-type stars. See Abstr. 1296

521.1/9 : 629.19

1272. Problems of escape from the earth's attraction and of gravitational movement round the earth. GENTY, R. C. R. *Acad. Sci., Paris*, 226, 1510-12 (May 10, 1948) *In French*.—The author contemplates a rocket given sufficient velocity to take it to a high altitude, then given either an escape velocity or a lateral speed sufficient to give it an orbit around the earth. The additional velocity will be less than it would have been at the surface; the author shows how it may be calculated in two stages, first deriving the velocity for constant g , then allowing approximately for its variation with the altitude.

T. L. MACD.

521.31 : 531.312

On Euler's equation and the theory of motion in a parabola. See Abstr. 1321

521.5 : 523.2

1273. Precision meridian observations of the major planets and comparison with theory as in the tables of Newcomb and Hill. ARMELLINI, G. *Comment. Pont. Acad. Sci.*, 8 (No. 11) 295-306 (1944) *In Italian*.—Observations of all the major planets (except Pluto) made at Campidoglio and Monte Mario (Rome) are reduced and compared with tables. Both the observations and corrections are consistent.

T. L. MACD.

522.6 : 535.33.072

1274. The relative efficiencies of spectrographs of moderate dispersion at the prime, cassegrain, and coude foci of large reflectors. WEAVER, F. *Publ. Astr. Soc. Pacif.*, 60, 79-97 (April, 1948).—Spectrographs of high dispersion should be placed at the coude focus, but it is shown that those of moderate dispersion (50 to 75 Å/mm) are most efficient at the cassegrain, and lens collimators are suggested to simplify mechanical difficulties. Numerical values of relative efficiency are given for numerous combinations.

D. L. E.

522.615 : 535.247.4 : 621.383

1275. An improvement in the use of photoelectric cells for stellar photometry. KRON, G. E. *Publ. Astr. Soc. Pacif.*, 59, 190-2 (Aug., 1947).—Gives details and wiring diagrams of a method which secures a gain of one stellar magnitude. This improvement would enable photocells to operate with a sensitivity equal to the older types plus multiplier amplification.

E. G. M.

523.72 : 523.755 : 551.510.535

Coronal radiation and ionospheric variations. See Abstr. 1581

523.72 : 621.396.11 : 551.510.535 : 538.566.3

Theory of interaction. See Abstr. 1502

523.161 : 523.87

1276. The gaseous clouds of interstellar space. ADAMS, W. S. *Publ. Astr. Soc. Pacif.*, 60, 174-89 (June, 1948).—A discussion of the distribution and motion of interstellar clouds is based upon a comprehensive study of absorption lines produced in stellar spectra. Larger clouds show little motion in the line of sight, but smaller and thinner clouds have radial velocities up to 100 km/sec.

R. A. N.

523.161 : 539.155.2

1277. A preliminary lower limit to the ratio C^{12}/C^{13} in interstellar matter. WILSON, O. C. *Publ. Astr. Soc. Pacif.*, 60, 198-200 (June, 1948).—Spectrograms of ζ Ophi. were examined for isotope lines in the spectrum of CH^+ . No trace of such lines was found and, from an estimate of minimum line intensity for detection, it was concluded that $C^{12}/C^{13} \geq 5$.

R. A. N.

523.43

1278. A meteorological approach to the question of water vapor on Mars and the mass of the Martian atmosphere. HESS, S. L. *Publ. Astr. Soc. Pacif.*, 60, 289-302 (Oct., 1948).—The author discusses the apparent discrepancy between the observations of clouds on Mars, probably water, and the small amounts of H_2O found by the spectroscope, < 0.5 mm of precipitable H_2O in the atmosphere. There are two probable types of cloud: (a) low-lying, fog-like, formed on the night side, for which it is shown 0.4 mm precipitable water would suffice; (b) high-level, convective cumulus, forming after noon, for which the author finds 0.6 mm precipitable water needed. The inconsistency is not great. The method used would give an estimate of the total atmospheric pressure if all the constants could be measured for one Martian cloud; available data lead to a surface pressure ~ 80 millibars (i.e., an amount of air $\frac{1}{2}$ less than that above Mt. Everest).

T. L. MACD.

523.5 : 551.51

1279. Meteor research. BUMBA, V. AND LINK, F. *Cas. Pěst. Mat. Fis.*, 73 (No. 3) 101-8 (1948) *In French*.—A discussion of the possibility of exploring the upper atmosphere with the help of meteors, for which the author devises a thermal classification based on laboratory data. Applying Öpik's theory to about 3 000 meteors, he obtains estimates of the density gradients of the atmosphere at heights between 50 and 150 km. In most cases it appears possible to derive the type and composition from the observed heights of the radiants and endpoints of meteors, particularly for faint ones whose spectra cannot be photographed.

A. B.

523.531 : 621.396.96

1280. Determination of meteor radiants by observation of radio echoes from meteor trails. CLEGG, J. A. *Phil. Mag.*, 39, 577-94 (Aug., 1948).—The variation with time of the rate of occurrence and the ranges of the radio echoes from meteor trails as the radiant moves across the heavens is explained and the ranges are estimated for any position of the radiant. Theoretical estimates agree well with experiment. With a horizontally narrow beam directed at sufficiently low elevation the ranges attain a sharp max. when the azimuth of the radiant differs from that of the beam by 90° . This is the basis of a method of radiant determination which may be used for finding unknown radiant positions. The accuracy depends on the echo rate, the declination of the radiant and the width and elevation of the aerial beam. Probable errors are $\pm 2^\circ$ in r.a. and $\pm 3^\circ$ in dec.

A.

523.6

1281. On the systematic changes of the eccentricities of nearly parabolic orbits. SINDING, E. K. *Danske Vidensk. Selsk. Mat.-fys. Medd.*, 24 (No. 16) 8 pp. (1948) *In English*.—The author tabulates those comets for which rigorous calculations are available, showing that the original orbit was in almost all cases more elliptic than the osculating path. The average difference (21 cases) in $1/a$ is 0.000552. Taking a simplified system consisting of comet distant from the Sun and Jupiter (in a circular orbit), the difference in $1/a$ produced by Jupiter becomes 0.000544, a perhaps accidentally close confirmation.

T. L. MACD.

523.71

1282. A 22-year oscillation of the sun's diameter. CIMINO, M. *Comment. Pont. Acad. Sci.*, 8 (No. 17) 485-504 (1944) *In Italian*.—The author tabulates the annual means of measures of the sun's semi-diameter made at Campidoglio, 1876-1937; the number of observations for each year averages > 400 . These means vary in an apparently systematic way between $960.6''$ and $961.8''$. The author applies harmonic analysis and derives a primary oscillation in rather over 22 years which would compare with the sunspot and magnetic cycles; there appear to be secondary oscillations.

T. L. MACD.

523.72 : 551.52.1

1283. The measurement of solar radiation. NICOLET, M. *Inst. Roy. Met. Belge Misc. (No. 21)* 37 pp. (1948) *In French*.—A critical survey of the present state of pyrheliometry and actinometry with a discussion of the modifying action of the earth's atmosphere on solar radiation reaching its surface.

D. R. B.

523.73 : 551.510.535 : 550.38.538

1284. Variation of the sun's ultra-violet radiation from ionospheric and geomagnetic observations. ALLEN, C. W. *Terr. Magn. Atmos. Elect.*, 51, 1-18 (March, 1946).—A study of the short and long-period variations of critical frequencies of the E , F_1 and F_2 layers at Washington, Huancayo, Watheroo and Mount Stromlo during 1937-44, and of amplitude variations in the S_q magnetic field at Apia, Watheroo and Cape Town during 1937-43. Conclusions are reached concerning the precise sources of solar u.v. light, the influence of this radiation on the 3 principal regions of the ionosphere [E , F_1 and F_2] and on the S_q magnetic field, the relations between sunspot numbers, u.v. radiation and critical frequencies of the ionized regions.

W. J. G. B.

523.746

1285. Sunspot activity during 1947. NICHOLSON, S. B. *Publ. Astr. Soc. Pacif.*, 60, 98-101 (April, 1948).—The number of sunspots in 1947 was the highest in the last century. (Largest relative sunspot number since 1749 was in May 1778: 238.9; second largest in May 1947: 206.5; third largest in December 1836: 206.2.) The 1947 Mount Wilson observations cover 337 days and comprise 663 spotgroups, 354 southern and 309 northern groups. Their average latitude was 17.2° and 17.4° , respectively. On 3 days no less than 22 groups were observed at one time. The April group was the largest ever photographed, 5 400-millionths of the solar hemisphere. 19 groups exceeded 1 000-millionths (in 1946 only 10 groups, and at the previous maximum in 1938 only 14). The magnetic activity, storms, etc., was unexpectedly low; but there was no solar flare of intensity 3. Of less intense flares 69 of intensity 1 and 10 of intensity 2 were seen in 2 449 observing hours.

A. B.

523.746

1286. Tetrapolar sun-spot groups. WALDMEIER, M. *Experientia*, 5 (No. 1) 44 (1949) *In German*.—It is shown that sun-spot groups are generally members of a "tetrapolar solar disturbance." Such a disturbance consists of four sun-spot groups occurring at almost the same time in the following positions on the sun's surface: (β, λ) , $(-\beta, \lambda)$, $(\beta, \lambda + \pi)$, $(-\beta, \lambda + \pi)$, β and λ denoting heliographic latitude and longitude.

A.

523.77 : 523.755

1287. The continuous spectrum of the sun and corona around 3 850 Å. DOPLICHER, V. *Atti Accad. Naz. Lincei (Mem. Cl. Sci. Fis. Mat. Nat.)* 1 (No. 3) 65-78 (1946) *In Italian*.—The author studies in detail the photometric material obtained at the 1936 eclipse by the Italian expedition to Sàra. Very careful corrections are made for atmospheric and instrumental effects. The profile of the depression which shows on the continuous spectrum of the corona around 3 850 Å is compared with that in the sun's spectrum. The two have the same profile within the limits of error; this is contrary to previous results with less powerful apparatus.

T. L. MACD.

523.77 : 525.7 : 535.33 : 551.593

1288. New bands in the telluric spectrum. McMATH, R. AND MOHLER, O. *Publ. Astr. Soc. Pacif.*, 60, 119-20 (April, 1948).—An important first result from the new all-reflecting spectrometer of the McMath-

Hulbert observatory is the discovery of new absorption bands at $\sim 20\,400$ and $20\,800\text{ \AA}$ in the solar spectrum. They are definitely of terrestrial origin, but cannot at present be identified with certainty. They are tentatively assigned to CO_2 . D. L. E.

523.77 : 535.33

1289. Molecular CH bands in the solar spectrum. NICOLET, M. *Inst. Roy. Met. Belge Misc. (No. 20) 52 pp. (1945) In French.*—A tabulation of 430 lines belonging to the electronic band systems of CH identifiable in the solar absorption spectrum. Wavelength differences between laboratory and solar lines are given. D. R. B.

523.77 : 535.33

1290. High-dispersion solar spectrum in the $10\,000\text{ \AA}$ to $20\,000\text{ \AA}$ region. McMATH, R. R. AND MOHLER, O. C. *Publ. Astr. Soc. Pacif.*, **59**, 267-9 (Oct., 1947).—The McGregor Solar Tower with the $f:50$ vertical refractor of 50 ft focal length and grating spectrograph was used in conjunction with a new lead-sulphide photoconductive cell with amplifier and Speedomax Recorder. A complete map of the infrared solar spectrum up to $20\,600\text{ \AA}$ has been obtained ($1.6\text{ mm/\AA}$). The CO_2 bands at $16\,000\text{ \AA}$ and $20\,000\text{ \AA}$ are resolved into individual rotation lines. It is proposed to extend the range with different equipment to $40\,000\text{ \AA}$. A. B.

523.82 : 523.851

1291. On the distribution of absolute magnitude in populations I and II. RUSSELL, H. N. *Publ. Astr. Soc. Pacif.*, **60**, 202-4 (June, 1948).—Suggests that stars may be embedded in a non-uniform distribution of prestellar matter. Stars would continue to be formed by condensation in regions where this matter is unexhausted, but the short-lived supergiants would disappear from regions containing a negligible amount of prestellar matter. R. A. N.

523.841.1 : 523.87

1292. Locations of origin of spectral features of novae. McLAUGHLIN, D. B. *Publ. Astr. Soc. Pacif.*, **59**, 244-50 (Oct., 1947).—The sequence of changes in novae spectra are grouped into (a) pre-maximum, (b) principal, (c) "diffuse-enhanced" and (d) Orion. Evidence given shows that these can be explained by a model in which (a) originates in a rapidly expanding deep shell, containing the effective photosphere, which is accelerated by radiation pressure to give the more displaced (b). The shell then becomes transparent to radiation from a P-Cygni-like atmosphere close to the star, from which (c) and (d) originate. D. L. E.

523.842.3

1293. Whirlpools of gas around binary stars. STRUVE, O. *Publ. Astr. Soc. Pacif.*, **60**, 160-73 (June, 1948).—The asymmetric distribution of periastra is discussed and is attributed to distortions of the velocity curves produced by rotating masses of gas enveloping the binary systems. R. A. N.

523.85 : 521.13

1294. Notes on the hydrodynamical treatment of stellar systems. MICZAIKA, G. R. *Astr. Nachr.*, **276**, 169-72 (Aug., 1948) *In German.*—The application of the conception of "mean free path" to a star-system is considered; the resulting values of the free path are

so high as to suggest that a star can easily leave the system. The author therefore considers how far the equations of hydrodynamics can be applied to a star system; also the incidence of turbulence, especially in the inner parts of the system. It would appear, however, that the motion is much better defined from a potential function due to the effect of all acting masses. T. L. MACD.

523.852.3

1295. On the definition of the dimensions of extra-galactic nebulae. DE VAUCOULEURS, G. *C.R. Acad. Sci., Paris*, **226**, 1692-4 (May 24, 1948) *In French.*—Discusses the difficulties in defining the limiting dimensions of these nebulae and suggest a more precise method derived from microphotometric studies of their brightness. E. G. M.

523.87 : 523.77 : 535.33 : 521.06

1296. A study of line intensities in the spectra of four solar-type stars. WRIGHT, K. O. *Publ. Dom. Astro-phys. Obs.*, **8** (No. 1) 116 pp. (1948).—Equivalent widths are given for about 800 lines in the region $3\,700\text{--}6\,750\text{ \AA}$, measured from high-dispersion spectrograms of the sun, γ Cygni, α Persei and α Canis Minoris, taken with the 72 in telescope. These intensities are applied to the theory of stellar atmospheres using the curve of growth method (a useful summary of which is given), with values of $\log X_i$ obtained for each line from an empirical solar curve of growth. Full details of the method and corrections employed are given with checks (when possible) by comparison with other workers. The derived turbulent velocities, excitation temperatures and relative abundances of 21 elements are discussed. D. L. E.

523.87 : 535.338.334

1297. On the theoretical calculation of the intensities of lines in stellar spectra. PECKER, J.-C. *C.R. Acad. Sci., Paris*, **227**, 1341-3 (Dec. 20, 1948) *In French.*—Minnaert's method of computing the equivalent widths of faint Fraunhofer lines, using Unsold's "weighting functions," is generalized to cover all types of absorption lines in the sun and stars. D. L. E.

523.874

1298. On the radial velocity of ζ Persei. BOUGUE, R. *C.R. Acad. Sci., Paris*, **226**, 1696-7 (May 24, 1948) *In French.*

523.877

1299. Radial oscillations of the limiting models of polytropic gas spheres. KOPAL, Z. *Proc. Nat. Acad. Sci., Wash.*, **34**, 377-84 (Aug. 15, 1948).—The radial stability of polytropes of indices $n = 0$ and $n = 5$ is considered. In the former case, that of a homogeneous sphere, it is found that the sphere can oscillate with discrete periods. This result, as the author points out, is due to Sterne. The author maintains that the polytrope $n = 5$, which is of finite central density but of infinite radius, can be converted into one of finite mass and dimensions provided the central density ρ_c and the constant $K = P/\rho^{1+1/n}$, where P and ρ are the pressure and density of the gas, both approach ∞ in such a way that $K^2/\rho_c^2 = \text{constant}$. Such a model is then found to be incapable of exhibiting radial oscillations of finite frequency and amplitude. V. C. A. F.

523.877 : 536.24

1300. Modern methods in the solution of the equation of transfer of radiation. GRATTON, L. *Riv. Nuovo Cim.*, **4** (No. 1) 29-73 (1948) *In Italian*.—The theory of heat transfer by radiation is essential in the discussion of stellar atmospheres. The phenomena are absorption, re-emission and diffusion. The author states the fundamental equations, reduces them to an integral equation and finds detailed solutions of the cases of plane, spherical and cylindrical layers. There is a discussion of the phenomenon of limb obscuration.

T. L. MACD.

526.918.5

1301. Study of aerial triangulation carried out with the solar periscope. MARCANTONI, A. AND SOLAINI, L. *Pubbl. Comm. Geod. Ital.*, **3** (No. 6) 5-39 (1948) *In Italian*.—Santoni introduced a surveying method using a camera which photographs simultaneously an area, the sun's disc and a chronometer. Instrumental errors together with random and systematic errors of orientation that arise in the method are investigated.

W. A. R.

527.6

1302. Long-range flight by single magnetic heading. GRINGORTEN, I. I. *Trans. Amer. Geophys. Un.*, **29**, 640-6 (Oct., 1948).—Describes a system which enables a navigator to plan a long-range flight requiring only one heading of the aircraft by his magnetic compass. Such a system makes possible automatic flying or the flight of pilotless aircraft. The paper shows how to

find the track that the aircraft should make good, giving one example of a cross-country flight near the 10 000 ft level.

A.

529.7

1303. Note on the isochronism of clocks and the maintenance of time. TIERCY, G. *Ann. Franç. Chronom.*, **2** (No. 1) 23-39 (1948) *In French*.—Two pendulums at the Geneva Observatory with ordinary knife-edge suspensions were not affected by earth tremors occurring on Jan. 25 and May 30, 1946. A third pendulum with a special ball suspension was stopped. None of them is isochronous if the amplitude changes. It is also known that pendulums with flat spring suspensions are not isochronous. The theory for both kinds is still incomplete, although noteworthy advances have been made by Tricomi and Haag. It is hoped to improve the maintenance of time at the Observatory by driving a quasi-free pendulum with constant impulses and by the use of a quartz clock.

L. E.

529.7

1304. Time and frequency standards. SPENCER JONES, H. *J. Inst. Navig.*, **2**, 1-8 (Jan., 1949).—The use of the quartz clock has resulted in a notable improvement in time prediction. It is, however, still a complex problem and the accuracy is limited by changes of rate and acceleration of the clocks, random and systematic errors in time observations, the motion of the earth's poles and possible changes in the rate of rotation of the earth.

L. E.

PHYSICS 53

53.081.1 : 621.3.081.1

1305. Further remarks on systems of electrical units. GIORGI, G. *Energia Elett.*, **25**, 443-5 (Aug., 1948) *In Italian*.—A recent paper by Brylinski [Abstr. 3325 (1948)] is critically examined. The term "absolute units" is redefined and it is argued that the Giorgi system, based on 4 fundamental units, is as absolute as the classical ones. New observations on the foundations of the Giorgi system are given and it is concluded that there is no argument in favour of a return to the classical systems even in the modified form suggested by Brylinski.

F. J. M.

53.082 : 550.312

The measurement of gravity. See Abstr. 1568

FUNDAMENTALS 530.1

530.12

1306. Approach to an understanding of the general theory of relativity. HUND, J. *Z. Phys.*, **124** (Nos 7-12) 742-56 (1948) *In German*.

530.12 : 530.145

1307. Some observations and new experiments [concerning relativity and the ether]. II-III. PRUNIER, F. *Arch. Sci.*, **1** (No. 1) 1-160 (1948) *In French*.—Some new relations are derived in the theory of the field of an electric particle moving relativistically along a straight line. The case of several particles describing parallel trajectories is also discussed. These results

make it necessary for the author to revive the hypothesis of the ether and a hydrodynamical theory of the ether is set up. In this Maxwell's equations are the most general equations of motion. The place occupied by the theory of relativity in the author's theory is examined and the essay concludes with a discussion of wave mechanics and the theory of the photon. [For previous work see Abstr. 1706 (1947) and *Nature*, **161**, 780 (May 15, 1948)].

L. S. G.

530.12 : 530.145.6

1308. Pauli's theorem for general relativistically invariant equations. GELFAND, I. M. AND YAGLOM, A. M. *J. Exp. Theor. Phys., USSR*, **18** (No. 12) 1096-1104 (1948) *In Russian*.—Results obtained in former work [Abstr. 3590 (1948)] are used to shed light on the question in what case charge and energy can, or cannot, be definite for wave fields described by a wave function ψ having an infinite number of components (and, particularly, when may charge and energy be simultaneously definite). The results themselves had already been reported in the previous paper.

A.

530.14

1309. Spin of the vector meson. BALSEIRO, J. A. *Publ. Fac. Cienc. Fis.-Mat. La Plata* (No. 195) 125-40 (1948) *In Spanish*.—A splitting of the total angular momentum of the vector meson field into an orbital momentum and a spin momentum is obtained. This splitting allows one to define a spin operator in a relativistic invariant way. The spin matrices are

formed by two submatrices which, as in the case of Dirac's electron, can be interpreted as corresponding, respectively, to mesons of charge $+e$ and $-e$. In a non-relativistic approximation the eigenfunctions of total angular momentum, for free mesons, can be considered as being a generalization of the eigenfunctions which were given by Pauli for the total angular momentum of the electron, also in a non-relativistic approximation. A.

530.14 : 530.145.6

1310. Correlativity ("conjugation") of charges for the general relativistically invariant equations. GELFAND, I. M. AND YAGLOM, A. M. *J. Exp. Theor. Phys., USSR*, **18** (No. 12) 1105-11 (1948) *In Russian*.—The results of previous work [Abstr. 3590 (1948)] are applied to the consideration of the problem of introducing the conception of the correlativity of charges (E. Majorana [Abstr. 4685 (1937); Kramers [Abstr. 971 (1938)]) into the general relativistically invariant equations. Results are discussed and examples given. A.

530.145

1311. Analytic behaviour of Heisenberg's S -matrix. EDEN, R. J. Letter in *Phys. Rev.*, **74**, 982 (Oct. 15, 1948).—The matrix for the scattering of light by H atoms is discussed when the energy available is low, and certain processes are impossible. The analytical continuation to these energies of the matrix elements for such processes must now be interpreted. A suitable interpretation is that the probability of the process, as defined, is negative if it is physically impossible. G. J. K.

530.145 : 537.12 : 538.1

1312. On the equations of propagation of waves in the theory of the Dirac electron in a magnetic field. PETIAU, G. *C.R. Acad. Sci., Paris*, **226**, 1687-9 (May 24, 1948) *In French*.—Fourth-order equations are obtained, which are satisfied by the wave-function components. The approximation of neglecting the magnetic moment in these equations then gives either the Gordon equation or a more complicated one containing the spin indirectly. G. J. K.

530.145 : 537.122

1313. Self-energy of the moving charge. MARKOV, M. A. *J. Exp. Theor. Phys., USSR*, **18** (No. 12) 1130-3 (1948) *In Russian*.—The expressions generally to be found in literature for the self-energy of a moving charge contain an explicit dependence on velocity of a form obviously inconsistent with the transformation properties of the quantities involved. It is shown that this fact is closely connected with the diverging integrals entering the said relations, and also that these relations may readily be brought into the correct form of dependence on velocity by means of simple transformations. A.

530.145.6

1314. Magnetic moment and virtual dissociation of nuclear particles. ARAKI, G. *Progr. Theor. Phys.*, **1**, 1-11 (July, 1946) *In English*.—The n and p magnetic moments are calculated with pseudoscalar meson theory, to first-order perturbation theory, giving a relation between them and the dissociation probability. The experimental values can be obtained with a large cut-off radius and an interaction constant $(f^2/\hbar c) = 8.9$. G. J. K.

530.145.6

1315. Exchange integral with $3d$ wave-functions. WOHLFARTH, E. P. Letter in *Nature, Lond.*, **163**, 57-8 (Jan. 8, 1949).—The exchange integral for electrons in $3d$ states on adjoining atoms is calculated assuming a wave-function $\psi = Nr^2e^{-dr}$, neglecting angular dependence, although this may be important. The integral is negative for large internuclear separation, in contrast with earlier suggestions. The singlet spin state is lower than the triplet. The sign of this integral is important in ferromagnetism. G. J. K.

530.145.6 : 535.43

1316. Note on the scattering of particles of zero-energy. POMERANCHUK, I. Letter to *J. Exp. Theor. Phys., USSR*, **18** (No. 12) 1146-7 (1948) *In Russian*.—Some inequalities are given to be satisfied by the effective scattering cross-sections of slow particles in a field of force in which there are no associated levels. In the case of a field of attracting forces not leading to associated levels, the effective scattering cross-section for slow particles is always $>$ Born's value and the amplitude of the scattered wave is positive, the opposite applying to a field of repelling forces. The wave function ψ used in the derivation had to be chosen as real, corresponding to $E = 0$. B. F. K.

530.145.6 : 538.1

1317. On the electromagnetic properties of nucleons. I. KOBAYASI, M. AND KANAI, E. *Progr. Theor. Phys.*, **1**, 21-6 (July, 1946) *In English*.—The cross-section is calculated by 4th-order perturbation theory for the scattering of photons by nucleons due to an intermediate pseudoscalar meson field. The nuclear mass is assumed large and the photon energy small. The final finite result can be accounted for by attributing an imaginary electric moment to the nucleon, in some ways similar to that of the electron. G. J. K.

530.145.6 : 539.18

1318. On the properties of the meson field. POTIER, R. *C.R. Acad. Sci., Paris*, **226**, 1690-2 (May 24, 1948) *In French*.—Nuclear forces are calculated using a meson field previously defined [Abstr. 2016 (1948)]. They include tensor forces $\propto (1/r)$ for small nuclear distances r . G. J. K.

530.145.65

1319. The self-oscillations of a charged particle. BOHM, D. AND WEINSTEIN, M. *Phys. Rev.*, **74**, 1789-98 (Dec. 15, 1948).—It is found that certain rigid charge distributions can oscillate without radiation even when no forces are present, other than their own retarded fields. The periods are of the order of the time required for light to cross the particle. The energy of these oscillations is always positive, and there are therefore no exponentially increasing unstable motions of the type possessed by the Dirac classical electron. The frequencies of these oscillations are such, that when quantized, the energy of the first excited state is of the order of the meson self-energy. Hence, it is suggested that some kinds of mesons may be electrons in such an excited state of self-oscillation. It is indicated that the principle of causality may have to be reformulated in terms of causal connections over finite intervals of time if one wishes to regard the electron plus its associated electromagnetic field as a single system. A.

530.162 : 537.312.67 : 621.316.8

1320. On the energy of electric fluctuations in conductors. PUMPER, E. YA. *J. Exp. Theor. Phys., USSR*, **18** (No. 12) 1112-29 (1948) *In Russian*.—Essential results obtained: (1) The measurements showed that in a series of thin metallic conductors and in graphite resistances the noise level was higher than would follow from the theory of the thermal effect, whereby the discrepancy with theory increases with frequency. (2) The experiment with an electrolyte and heat treatment of the resistances showed that apart from the thermal effect the fluctuations are determined by an additional uncommon unbalance effect. (3) Tests on heated resistances revealed that additional noises may be silenced by rapid heating. (4) The tests with electrolytes as well as with heated resistances may be taken to indicate that the observed rise of the fluctuation level above the theoretical value may be due to energy issuing from the crystal lattice and be connected with crystallization phenomena. A.

hour-glass shaped figure seen in the microscope. This is most conveniently done photographically. 4 different observers, using the same optical system, obtained values for the correction varying between 0.81×10^{-5} and 1.04×10^{-5} cm. The spheres used were sufficiently equal for any difference in radius to be neglected. N. C.

531.717.3 : 621.317.39

1324. Variable-resistance spring transducer. *Amer. J. Phys.*, **16**, 434 (Nov., 1948).—A spiral spring is so wound that the turns separate one by one, rather than simultaneously, when stretched. The electrical resistance approximates to a cylindrical tube when closed, and rises rapidly when stretched, the % resistance change being hundreds of times > the % length change. Displacements of 10^{-5} in can be measured.

531.752

1325. Construction and special uses of quartz helix balances. KIRK, P. L. AND SCHAEFFER, F. L. *Rev. Sci. Instrum.*, **19**, 785-90 (Nov., 1948).—A technique is described for the construction of uniform smooth quartz helix balances of any desired sensitivity or load capacity by mechanical means. Some of the less common but highly desirable uses of such balances are listed. A.

531.752 : 621.317.39

1321. On Euler's equation and associated relationships in the theory of motion in a parabola. STUMPF, K. *Astr. Nachr.*, **276**, 164-8 (Aug., 1948) *In German*.—The author shows that all the geometrical constants and equations of undisturbed motion in a parabola can be derived from 3 independent local invariants; these are obtained in a convenient form and are unaffected by change of co-ordinates. It is shown that Euler's equation, as used in calculating cometary orbits, can be readily derived from the invariants, together with its special cases. The method leads to convenient new relationships between points on a parabolic orbit and the corresponding velocities, and to a neat geometrical method of deriving the direction and magnitude of the velocity at any point defined by its position angle from the focus. T. L. MACD.

531.12 : 521.31

1326. Radioactive electronic detector. FEUER, I. *Analyt. Chem.*, **20**, 1229-37 (Dec., 1948).—Describes a sensitive microbalance indicator in which the unbalance in a 3-plate ionization chamber is amplified and indicated when a radio-active foil attached to the balance arm moves. Sensitivity at least $1 \mu\text{g}/\text{mm}$ deflection of spotlight galvanometer; load capacity 25-50 g/pan.

531.761 : 621.385.832

1327. A time interval and reference line marker for moving film photography of oscilloscope traces. KAMMER, E. W. *Rev. Sci. Instrum.*, **19**, 805-7 (Nov., 1948).—A device is described which produces a reference light beam capable of being modulated at any desired frequency up to several thousand c/s. The light source can be mounted on the face of most oscilloscopes with slight alterations. It facilitates the introduction of a timing scale and fixed reference line when photographic recordings are made of oscilloscope traces by means of drum or continuously moving film cameras. A.

531.768

1328. Calibration of accelerometers. LEVY, S., MCPHERSON, A. E. AND HOBBS, E. V. *J. Res. Nat. Bur. Stand., Wash.*, **41**, 359-69 (Nov., 1948).—Describes three accelerometer calibrators. The first is a shaking table having a sinusoidal motion with frequencies of 20-110 c/s and accelerations up to 80 g; the second is a portable calibrator producing a known pulse of acceleration with a peak value between 1 and 20 g; and the third is a centrifuge, which develops a maximum steady acceleration of about 1 000 g. A.

531.781.2 : 621.317.39

1329. An autographic stress relaxometer. STEIN, R. S. AND SCHAEVITZ, H. *Rev. Sci. Instrum.*, **19**, 835-9 (Dec., 1948).—Designed and constructed for studying the relaxation of the stress of a polymer

GENERAL MECHANICS

MECHANICS OF SOLIDS 531

MECHANICAL MEASUREMENTS 531.7

531.71 : 535.41

1322. Light waves as standards of length. BARRELL, H. *Research, Lond.*, **1**, 533-40 (Sept., 1948).—A general and historical survey. The Kôsters and National Physical Laboratory gauge interferometers are described. A bibliography and 39 references are given. H. H. HOP.

531.71 : 535.42

1323. Microscopic method for determination of the size of selenium spheres of radii between 3×10^{-5} cm and 35×10^{-5} cm. SCHEDLING, H. *Acta. Phys. Austriaca*, **2** (No. 1) 13-22 (1948) *In German*.—Owing to diffraction effects, the apparent radius as seen through the microscope is > the true radius. The magnitude of the correction to be applied is found by allowing two spheres of the same size to touch, and measuring the overall dimensions of the resultant

film elongated to constant length. The force-measuring element is a linear variable differential transformer which measures the distortion of a flexible steel ring and drives a recorder. The sample is elongated to the desired length automatically, and the correct length is maintained by means of a second differential transformer. A.

531.788

1330. A stable Pirani-gauge circuit for indication and control of vacuum equipment. SCHWARTZ, C. M. AND LAVENDER, R. *Rev. Sci. Instrum.*, **19**, 814-15 (Nov., 1948).—A gas tube stabilized mains supply feeds the gauge bridge and the pair of cathode followers used to drive the meter (0-1 mA). The gauge and the reference arm are both 115 V 10 W. Tungsten lamps run at 10 mA (below red heat) and give a 1 V p.d. from the bridge for the pressure range of 0-100 microns. Circuit values, adjustment procedure, and an auxiliary control circuit designed to operate at a predetermined pressure level, are given. T. E.

531.788

1331. A combined thermocouple and cold-cathode vacuum gauge. GARROD, R. I. AND GROSS, K. A. *J. Sci. Instrum. Phys. Ind.*, **25**, 378-83 (Nov., 1948).—The design, construction and performance of a vacuum gauge covering the range 10^{-1} to 10^{-5} mm of Hg are described. It consists essentially of two elements in a common envelope; a thermocouple gauge for pressure measurement in the range 10^{-1} to 10^{-3} mm, and a cold-cathode discharge gauge for pressures below 10^{-3} mm. A simple means for initiating the discharge in the latter gauge at low pressures is included. Design data for optimum performance of each element are discussed, and the cause of the "reversal effect," common in thermocouple gauges, has been investigated. A.

MECHANICS OF FLUIDS 532

532.13

1332. Irany's temperature function of viscosity. PRASAD, B. *Phil. Mag.*, **39**, 645-9 (Aug., 1948).—It is shown that the function, supposed linear in temp., is not compatible with Andrade's equation [Abstr. 1480 (1934)], and has only a limited range of validity. A number of similar functions may be developed but it is impossible to develop a function which is linear over a large range of viscosity for all liquids. L. S. G.

532.13 : 539.37

1333. Kinetic theory of the viscosity of amorphous bodies. KOCHENDORFER, A. *Z. Naturforsch.*, **3 A**, 329-40 (June, 1948) *In German*.—Assuming a rigidity modulus of the same order in viscous as in solid materials, the author derives an expression for the viscosity in terms of temp., rigidity and molecular constants. The theory is based on the view that the viscous flow of amorphous substances or liquids is of the same nature as the thermally activated gliding of crystals under stress. Results are compared with experiment for glass and molten metals. G. O. J.

532.137

1334. A new type of viscosimeter. ELKARIM, A. A.

Amer. J. Phys., **16**, 489-90 (Dec., 1948).—A small air index is driven along a horizontal capillary tube, the pressure difference being due to a head of the liquid whose viscosity is being measured. The velocity is measured directly, and the viscosity deduced from the gradient of the graph of head against velocity, using Poiseuille's equation. This graph does not pass through the origin, as there is a constant difference between the head and the effective pressure, due to surface tension. The apparatus gives good results for viscosities between 0.0055 and 0.042 c.g.s. units. N. C.

532.137

1335. A new form of viscometer for transparent viscous liquids. ELKARIM, A. A. *Rev. Sci. Instrum.*, **19**, 833-4 (Dec., 1948).—Based on the application of Stokes's law. The method is to allow air bubbles to rise through a liquid placed in a glass cell. A.

532.51 : 535.55 : 539.37

1336. Motion and deformation of an elastic, spherical particle in a viscous stream at constant velocity gradient. CERF, R. *C.R. Acad. Sci., Paris*, **226**, 1586-8 (May 19, 1948) *In French*.—The work of Haller [Abstr. 11 (1933)] relating to the deformation of an elastically isotropic and homogeneous spherical particle in a viscous stream at constant velocity gradient is amplified. See also Jeffery [Abstr. 2357 (1923)] and Taylor [Abstr. 4397 (1934)]. J. S. G. T.

532.51 : 535.55 : 539.37

1337. Macromolecular physics. Maxwell effect (flow birefringence) in suspensions of deformable particles. I. Generalities. Brownian movement of rotation and deformation of a spherical elastic particle. CERF, R. *C.R. Acad. Sci., Paris*, **227**, 1221-3 (Dec. 8, 1948) *In French*.—Reference is made to authors who suggest flow birefringence arises as a result of particle deformation. Following this, the influence of thermal agitation on an elastic sphere (radius 50-500 Å) is considered, whereupon (a) for feeble Brownian movement, the movements of displacement and deformation are independent and (b) $\bar{X}_{ii}^2 = kT/VE$; $\bar{X}_{ii}\bar{X}_{jj} = kT/V \cdot \sigma/E$ where X_{ii} and X_{jj} are the principal coefficients of deformation, k is Boltzmann's constant, T is the absolute temperature, V is the particle volume, E is Young's modulus and σ is Poisson's ratio. The behaviour of the sphere submitted to both a hydrodynamic field and thermal agitation is mentioned and for a representative point a Gaussian law of distribution holds. [See Abstr. 11, 4728 (1933); 96 (1935); 946 (1936)]. H. G. J.

532.51 : 535.55 : 539.37

1338. Macromolecular physics—Maxwell effect in suspensions of deformable particles. II. Dynamical-optical properties of a suspension of elastic spheres. Application to solutions of chain-like macromolecules. CERF, R. *C.R. Acad. Sci., Paris*, **227**, 1352-4 (Dec. 20, 1948) *In French*.—The author discusses the birefringence of an infinitely dilute suspension of elastic spherical particles initially optically isotropic, but deformed to anisotropy when flowing under a small constant velocity gradient. An expression for the birefringence is derived in the form of the product of a mechanical factor dependent upon thermal agitation and an optical factor. Contrary to the result obtained in the case of solutions of rigid particles, it is the

optical factor that is found to depend upon the velocity gradient, the mechanical factor being a constant so far as the first approximation is concerned. The theory is applied briefly to the case of the poly-isobutylenes and poly-styrolenes. J. S. G. T.

532.59

1339. Diffraction of water waves by breakwaters. PUTNAM, J. A. AND ARTHUR, R. S. *Trans. Amer. Geophys. Un.*, **29**, 481-90 (Aug., 1948).—Application is made of a solution of the water-wave diffraction problem of Penny and Price to diffraction by a semi-infinite impermeable breakwater. Approximations are introduced to simplify application of the theory. Comparison of complete and simplified solutions is made with results obtained from a laboratory investigation. Best agreement between theory and experiment occurred in the lee of the breakwater. The simplified solution is shown to be adequate for most practical applications. A.

CAPILLARITY 532.6

532.61

1340. Determination of surface tension of molten materials. DAVIS, J. K. AND BARTELL, F. E. *Analyt. Chem.*, **20**, 1182-5 (Dec., 1948).—A simple and apparently accurate method for the determination of surface tension (by pendant drop measurements) at elevated temperatures is presented. Measurements on molten glass, resins, waxes, metals and metallic oxides are described. A.

532.61 : 541.183.02

1341. Hysteresis of the contact angle. GREGG, S. J. Letter in *J. Chem. Phys.*, **16**, 549-50 (May, 1948).—The angle of contact θ of a liquid (surface tension γ_L) against a solid is much influenced by the presence of an adsorbed film on the unimmersed portion of the solid. For a mobile film one has $F_L - \pi = \gamma_L \cos \theta$, where F_L is the diminution in free energy when 1 cm^2 of the clean solid is immersed in liquid, and π is the surface pressure of the adsorbed film. If there is adsorption hysteresis A it will, by affecting π , result in contact angle hysteresis B. A, though aggravated by presence of impurities, may sometimes persist in their absence (e.g. due to phase changes in the film), so that B will often but not always be eliminated by taking precautions as to cleanliness, time for equilibration, etc. S. J. G.

532.62

1342. The use of spread films on mercury for investigating the positions of attracting poles of molecules and the rôle of these poles in various physical properties of matter. DEVAUX, H. *C.R. Acad. Sci., Paris*, **226**, 1649-51 (May 24, 1948) *In French*.—Distilled water spreads very badly on an Hg surface but if it contains a trace of CuSO_4 it spreads rapidly. A film of CuSO_4 molecules is adsorbed on the Hg surface and if this film is compressed it becomes insoluble in water and thus rigid. The conclusion is that the hydrophilic "pole" of the molecule is blocked by being directed to the Hg. If the number of salt molecules is greater than is necessary to cover the Hg with a monomolecular layer the excess is gathered into small crystalline regions which retain their

solubility. The author states that this is a general phenomenon and applies to a large number of inorganic and soluble organic compounds. The intermolecular forces involved are briefly discussed. J. I.

532.685 : 539.215.9 : 539.217.3

1343. Influence of the grain shape of a filtering layer on the velocity of the filtration current. KLYACHKO, V. A. *Dokl. Akad. Nauk, SSSR*, **60** (No. 8) 1329-32 (1948) *In Russian*.—The premises on which theoretical treatment must be based are as follows: (1) the movement of the liquid through a granular porous stratum occurs exactly like the passage through a bunch of capillaries, the difference of pressures between inlet and outlet being the same for each capillary; (2) all pores of the filter medium are full of liquid and the whole of the liquid is moving. The friction on the tube wall is assumed in the form suggested by Leibensohn and the constant in this law expressed as a function of the Reynolds number. Experimental data prove that the flow through the capillaries in a significant range of velocities may be assumed as laminar. It was furthermore assumed that the flow of the liquid round the grains of the filter material is a phenomenon closely akin to the fall of such grains through a column of liquid at rest. This supposition was checked and found confirmed by experiment. Experiments also confirmed the correctness of the whole theory and in particular that the calculated shape factor is the ratio of the volume of the average grain of the filter material to its surface area. For natural sands this shape factor varies from 0.167 (for spherical well-ground sands) to 0.120 for crushed marble with angular, flat grains. B. F. K.

MOLECULAR THEORY OF LIQUIDS 532.7

532.7 : 536.48 : 536.71

Quantum theory of condensed permanent gases. See Abstr. 1441

MECHANICS OF GASES 533

533.15 : 539.3/4

1344. The diffusion of decomposition products through plastic materials. WARD, A. G. *Phil. Mag.*, **39**, 621-32 (Aug., 1948).—Certain plastics show slow decomposition and resulting evolution of gas, and in thick sections the concentration may increase to a point where the pressure in a minute cavity may split the material. A mathematical method is derived for obtaining the relation between concentration, time and position for simple cases. The problem is solved for certain shapes, given the rate of formation of a product, its diffusion constant, its solubility and the boundary conditions. The equations of this problem are the same as those for dielectric heating which may thus be treated by the same method. L. S. G.

533.51/57

1345. The speed of oil and mercury diffusion pumps for hydrogen, helium, and deuterium. DAYTON, B. B.

Rev. Sci. Instrum., **19**, 793-804 (Nov., 1948).—Data on several standard diffusion pumps indicate that the speed for H may be considerably less than $3.8 \times$ the rated speed for air depending on the jet design, pump fluid, heater input and speed of the fore pump. Evidence is presented that this reduction in speed is partly the result of diffusion of H back through the vapour jet from fore vacuum to high vacuum and partly the result of diffusion of H back out of the jet after entering from the high vacuum side. Measurements of the back diffusion of H, He and air in an experimental pump are correlated with the diffusion coefficient through an extension of the theories of Gaede and Matricon. The mechanism of jet breakdown has been observed with the aid of a glow discharge and a pilot dye.

A.

533.51/.57

1346. The speeds of diffusion pumps for gases of low molecular weight. BLEARS, J. AND HILL, R. W. *Rev. Sci. Instrum.*, **19**, 847-51 (Dec., 1948).—The evidence for a general relationship between the speed of a diffusion pump and the m.w. of the gas being pumped is reviewed. Experiments are described which show that when pumps are operated at their normal ratings, the speeds for H and He may be considerably lower than for N, and it is established that this is due to the relative ease with which the lighter molecules diffuse from the fore-vacuum to the high vacuum side of the jet. The speeds of diffusion pumps for different gases are not in fixed ratios, but in ratios which depend upon the fore-vacuum pressure and the heat input to the pump boiler. At heater wattages exceeding twice normal the inverse $(M)^{1/2}$ law may sometimes be obeyed.

A.

533.6.011.5

1347. On source and vortex distributions in the linearized theory of steady supersonic flow. ROBINSON, A. *Quart. J. Mech. Appl. Math.*, **1**, 408-32 (Dec., 1948).—The hyperbolic character of the differential equation satisfied by the velocity potential in linearized supersonic flow entails the presence of fractional infinities in the fundamental solutions of the equation. Difficulties arising from this fact can be overcome by the introduction of Hadamard's "finite part of an infinite integral." Together with the definition of certain counterparts of the familiar vector operators this leads to a natural development of the analogy between incompressible flow and linearized supersonic flow. In particular, formulae are derived for the field of flow due to an arbitrary distribution of supersonic sources and vortices.

A.

533.6.011

1348. The method of characteristics for problems of compressible flow involving two independent variables. Part II. Integration along a Mach line. The radial focusing effect in axially symmetrical flow. MEYER, R. E. *Quart. J. Mech. Appl. Math.*, **1**, 451-69 (Dec., 1948).—The paper deals with the growth and decay of disturbances along Mach lines in isentropic, irrotational, steady, 2-dimensional or axially symmetrical, supersonic flow; in particular, the distribution of disturbances is investigated along a Mach line in axially symmetrical flow on which the velocity is constant. As an example, the field of flow in the entry of a contractor of circular cross-section is

calculated from the focusing laws, and the analytical expressions are compared with the results of the numerical methods of Massau and Tupper. The disturbance generated by the diffuser entry leads to a singularity of the flow pattern on the axis, the nature of which is investigated within the framework of linear theory.

A.

533.6.011 : 531.553

1349. On the hodograph transformation for high-speed flow. I. A flow without circulation. GOLDSTEIN, S., LIGHTHILL, M. J. AND CRAGGS, J. W. *Quart. J. Mech. Appl. Math.*, **1**, 344-57 (Sept., 1948).—In Abstr. 3441 (1947) a solution is given to the problem of finding, by use of the hodograph transformation, steady plane isentropic flows round contours, reducing to given incompressible flows when the Mach number at ∞ tends to zero. The solution contains an arbitrary function and therefore gives an ∞ of such flows for each incompressible flow, when circulation is absent: with circulation, however, only one determination of this arbitrary function is permissible. In this paper an alternative method of solution is indicated. This method is not so easy to put into a general form, so it is set out for the case when the incompressible flow is the symmetrical one about a circle. Various possible generalizations are indicated. The approach is presented as one which helps to clarify understanding of the use of the hodograph transformation for the study of the flow around bodies and as one which may suggest future investigations on the application of the transformation.

A.

533.6.011 : 531.553

1350. On the hodograph transformation for high-speed flow. II. A flow with circulation. LIGHTHILL, M. J. *Quart. J. Mech. Appl. Math.*, **1**, 442-50 (Dec., 1948).—A steady 2-dimensional isentropic compressible fluid flow about a contour with circulation, reducing to the potential flow with circulation about a circle as the Mach number at ∞ tends to zero, is specified in the hodograph plane.

A.

533.6.011.311

1351. Application of a heated wire to the visual and acoustic study of the transition [state] in the boundary layer. MÉNARD, M. AND MICHEL, R. *C.R. Acad. Sci., Paris*, **226**, 1686-7 (May 24, 1948) *In French*.—Transition from stream-line to turbulent motion in the boundary layer is customarily studied by means of a stethoscopic device. The authors employ a heated wire (dia. 0.012 mm) inserted in the boundary layer at a distance of 0.5 mm from the wall, the p.d. between the ends of the wire being transmitted to the grid of a low-frequency amplifier, and the output current transmitted both to an electrodynamic loudspeaker and to a c.r. oscillograph. The output current from the amplifier, rectified by a thermocouple, is passed through a damped moving-coil galvanometer in order to ascertain the mean intensity of the motion in the boundary layer. The galvanometer deflection depends upon the position of the heated wire.

J. S. G. T.

533.6.011.5

1352. The behaviour of the velocity along a straight characteristic in steady irrotational isentropic flow with axial symmetry. HOLT, M. *Quart. J. Mech. Appl. Math.*, **1**, 358-64 (Sept., 1948).—Attention is confined

to the steady irrotational isentropic flow of a perfect gas at supersonic speeds, in particular, flow in which one characteristic is straight. In 2 dimensions any characteristic along which the velocity is constant in magnitude and direction is straight and, conversely, if a characteristic is straight the velocity must be constant along it; in 3-dimensional flow with axial symmetry the velocity along a straight characteristic is not generally constant but varies according to a definite relation with the radial distance. This relation is established and the types of flow corresponding to it described. A.

533.6.013.22 : 519.21 : 621.317.35

1353. Spectral analysis of an irregular function. BURGERS, J. M. *Proc. K. Ned. Akad. Wet.*, **51** (No. 9) 1073-6 (1948) *In English*.—Part I of a mathematical development of the filter in the device described in Abstr. 1354 (1949), analysing the concept of the spectrum of an irregularly-oscillating time function, e.g. the velocity v of a turbulent flow. L. J. G.

533.6.013.22 : 621.317.35

1354. Spectral analysis of turbulence. BETCHOV, R. *Proc. K. Ned. Akad. Wet.*, **51** (No. 9) 1063-72 (1948) *In French*.—A device for electronically measuring the velocity fluctuations in a turbulent aerodynamic flow using a hot-wire anemometer and thermocouple, the indications of which are applied to the grid of a thermionic valve through a low-pass filter with very large time constant thus assuring a strictly linear recording. The theory and layout of the circuit are outlined and test results given. L. J. G.

533.6.08 : 621.317.39

1355. Constant temperature operation of the hot-wire anemometer at high frequency. OSSOFKY, E. *Rev. Sci. Instrum.*, 881-9 (Dec., 1948).—Constant temp. operation of the hot-wire anemometer offers advantages in the study of large velocity fluctuations, of frequency as high as 30 kc/s. To avoid spontaneous oscillations in this type of instrument, a carefully designed bridge and amplifier are necessary. Such a design, treating the whole instrument as a feedback amplifier, is presented, and minimum requirements for the amplifier proper are found in terms of wire parameters. The thermal noise level of the constant temp. instrument is calculated to be 5 times higher than that of a comparable constant-current instrument because of the additional bandwidth necessary for stable operation. A.

533.6.69

1356. The position of the shock-wave in certain aerodynamic problems. LIGHTHILL, M. J. *Quart. J. Mech. Appl. Math.*, **1**, 309-18 (Sept., 1948).—For the motions caused by the uniform expansion of a cylinder or sphere into still air, and for steady symmetrical supersonic flow past a cone, first approximations are obtained to the strength and position of the shock-wave for small disturbances. It is also shown what are the correct approximations to the pressure on the surface. The work is mathematically rigorous, and provides some justification of approximate methods that have been used, e.g., in the general theory of supersonic flow past bodies of revolution. A.

533.6.69

1357. On a solution of the laminar boundary-layer equation near a position of separation. JONES, C. W.

Quart. J. Mech. Appl. Math., **1**, 385-407 (Dec., 1948).—This paper discusses a solution of the laminar boundary-layer equations published by Professor S. Goldstein [Abstr. 83 (1949)]. Conditions near an assumed singularity at a point of separation are investigated numerically, tables are given for general use, and a comparison is made with numerical information from other sources. In addition, an improved form of the "outer" solution of Kármán and Millikan is described. A.

533.6.691

1358. Aerofoils of maximum thickness ratio for a given maximum pressure coefficient. MANWELL, A. R. *Quart. J. Mech. Appl. Math.*, **1**, 365-75 (Dec., 1948).—A relation is found which determines the symmetrical aerofoil which in streaming incompressible or subsonic compressible flow has the greatest thickness ratio for a given maximum pressure coefficient. The solution in the incompressible case coincides with that of a free streamline problem due to Riabouchinsky. The Kármán-Tsien solution is derived in a very similar form. It is also shown how in principle one experiment with an electric potential apparatus would solve the problem for any pressure-density law. The method of deriving the relation can be extended to various similar problems, including axially symmetric flow, and the solution possesses the further property of maximizing the area and other functions of the contour of the aerofoil. A.

533.6.691 : 533.6.013.22

1359. The flat delta wing at incidence, at supersonic speeds, when the leading edges lie outside the Mach cone of the vertex. ROPER, G. M. *Quart. J. Mech. Appl. Math.*, **1**, 327-43 (Sept., 1948).—H. J. Stewart's analysis using the linearized equation of supersonic flows for finding the lift of a flat delta wing at supersonic speeds when the leading edges of the wing lie within the Mach cone of the vertex, is extended to the case when the leading edges lie outside the cone. From the condition specified on the wing, Fourier expansions are found for the downward vertical induced velocity component w , outside and on the Mach cone of the vertex. The constant velocities on the wing, outside the Mach cone, are deduced from the shock-wave relations across the Mach planes of the leading edges. Fourier expansions are found for the axial and transverse disturbance velocities u , v , the constancy of these velocities, in regions outside the Mach cone, being deduced from the vorticity relations. The methods of the complex variable, used by Stewart, are used to obtain the induced velocity components inside the Mach cone of the vertex. The solution for the velocity component w is found from the conditions to be satisfied on the wing and on the Mach cone. Hence, by using the vorticity relations and the Cauchy-Riemann relations, the solutions for the velocities u , v are found. The pressure distribution on the wing is deduced, and the total lift calculated, by integrating the pressure difference over the surface of the wing. The lift coefficient, based on area, is found to be independent of the angle of the wing. The corresponding drag coefficient is also found. A.

533.6.69

1360. Drag of an airfoil in accelerated supersonic flight. GARDNER, C. S., LUDLOFF, H. F. AND

REICHE, F. *J. Appl. Phys.*, **19**, 1179-80 (Dec., 1948).—Disturbance caused by an airfoil is represented by a perturbation potential function obtained by solving a fundamental differential equation subject to stated boundary conditions. The required solution involves two quadratures and the integrations can be performed to include a term representing the accelerated motion of the leading edge. An expression representing the instantaneous drag coefficient is obtained in the case where the acceleration is very small. A second order term in the expression indicates a decrease effect on the drag coefficient $\propto$ acceleration². G. G.

viscously-plastic materials, based on the stress-strain relationships developed by Hohenemser, Prager and Ishlinsky. The final equations are brought to a non-dimensional form and their application shown in the case of a semi-infinite conical rod for which values of the wave period and residual deformations are calculated. L. J. G.

534.2

1364. Velocity of sound in liquid oxygen. VAN ITTERBEEK, A. AND DE BOCK, A. *Physica*, 's Grav. **14**, 542-4 (Dec., 1948) In English.

534.22 : 534.13

1365. Measurements on the velocity of sound in mixtures of hydrogen, helium, oxygen, nitrogen and carbon monoxide at low temperatures. VAN ITTERBEEK, A. AND VAN DONINCK, W. *Proc. Phys. Soc., Lond. B*, **62**, 62-9 (Jan., 1949).—By means of a quartz oscillator ultrasonic radiation is emitted into a gas at a pressure which can be varied. Experimental values of the velocity of sound for various concentrations of the constituent gases at various temperatures are recorded. These values refer to an ideal state of the mixture at zero pressure. Numerical values are given which enable the velocity under increased pressure to be calculated in accordance with a theoretical equation which involves a certain empirical relation between the second virial coefficient for the mixture and the corresponding virial coefficients for its components. This empirical relation is provided by measurements recorded in a previous paper [Abstr. 2811 (1946)]. All the experimental results recorded are in agreement with the theoretical equation referred to except those relating to H_2-N_2 mixtures. G. G.

534.22 : 534.321.9

1366. Experimental determination of velocity of sound in superheated steam by ultrasonics. WOODBURN, J. *Trans. Amer. Soc. Mech. Engrs*, **71**, 65-72 (Jan., 1949).—A quartz crystal is used as a sound source to set up a series of standing waves in a vertical cylinder filled with steam. The frequency of the sound and the length of the standing waves are measured with high accuracy by simple methods. Experimental results are presented which show close agreement with data calculated from the steam tables of Keenan and Keyes. A.

534.222.1

1367. Propagation of cylindrical displacement waves in an elasto-visco-plastic medium. SOKOLOVSKI, V. V. *Dokl. Akad. Nauk, SSSR*, **60** (No. 8) 1325-8 (1948) In Russian.—The investigation is based on the assumptions of the Hohenemser-Prager theory and the case of axial symmetry about the z-axis of the cylindrical co-ordinates $r\theta z$ is considered. Waves on whose front the stress components $\tau_{r\theta}$ and deformations $\gamma_{r\theta}$ and the velocity v_θ suffer discontinuities represent shock waves. The characteristic equations of the wave system are of the hyperbolic type and have to be supplemented by the kinematic and dynamic compatibility condition applying to the wave front. The dependent variables of the system of equations as well as the original constants are suitably transformed and substituted by a corresponding number of dimensionless parameters which converts the original equations in a system of comparatively simple 1st order equations, solvable by quadratures. This

MOLECULAR THEORY OF GASES 533.7

533.7 : 531.19

1361. Behaviour of admixtures in a slightly non-ideal degenerate gas obeying Bose-statistics. TYABLIKOV, S. V. *J. Exp. Theor. Phys., USSR*, **18** (No. 11) 1023-9 (1948) In Russian.—The gas is considered as heavily degenerate. The problem of the energy spectrum of a particle interacting with a system having a large number of degrees of freedom is treated. On the assumption of the correctness of the usual theory of excitation the kinetic equation for the particles of the admixture is derived. From its stationary solutions it follows that the admixture particles are in thermal equilibrium with the elementary excitations, taking part together with the latter in the movement of the normal part of the Bose-gas. A.

VIBRATIONS . ACOUSTICS 534

534.11 : 517.5

Phase characteristics of exponential functions. See Abstr. 1261

534.2 : 550.34

1362. Behaviour of Rayleigh waves in a solid-elastic infinite medium. CALOI, P. *Ann. Geofis.*, **1**, 550-67 (Oct., 1948) In Italian.—The propagation velocity of the waves, starting from infinity for zero period, falls rapidly to the value obtaining for purely elastic media as the period increases. The fall is the steeper the greater the ratio μ/μ' (where μ is Lamé's constant, μ' the internal damping factor of the volume unit). For waves with large periods the effect of internal damping is nearly zero and the medium behaves as a purely elastic one. Classical theory considers the Rayleigh waves as free, persistent, and not subject to absorption by the medium, yet observation proves that strongest absorption occurs for the smallest periods, decreasing rapidly and reaching a value of $\sim e^{-0.0003}$ for periods ~ 20 sec. The new theory proves that in a rigid-elastic medium, with $\mu/\mu' = 50 \text{ sec}^{-1}$, this is the case. B. F. K.

534.211 : 539.374

1363. Propagation of elastic and viscously-plastic waves in rods. SOKOLOVSKI, V. V. *Dokl. Akad. Nauk, SSSR*, **60** (No. 5) 775-8 (1948) In Russian.—Analysis of the propagation of waves in rods of elastic and

formal method has to be supplemented by a graphical procedure when it is required to describe the actual propagation process of the displacement waves and to find stress and deformation components as well as velocities. Where numerical results are wanted, these are conveniently found by difference equations.

B. F. K.

534.24

1368. On the total reflection of plane waves. FRIEDLANDER, F. G. *Quart. J. Mech. Appl. Math.*, **1**, 376–84 (Dec., 1948).—The reflection and refraction of transverse plane waves at an interface $\parallel$ to the direction of polarization is considered when the incident wave is of arbitrary shape and the angle of incidence exceeds the critical angle. It is shown that the solution of this problem depends on the determination of a plane harmonic function $h(\xi, \eta)$ satisfying the condition

$$\left(\frac{\partial h}{\partial \xi}\right)_{\eta=0} - \lambda \left(\frac{\partial h}{\partial \eta}\right)_{\eta=0} = 2f'(\xi),$$

where λ is a known constant and $f'(\xi)$ a given function. By using the $\frac{1}{2}$ -plane analogue of Poisson's formula, $h(\xi, \eta)$ can be expressed in terms of $f'(\xi)$. The results show that the reflected and transmitted disturbances exist everywhere at all times even when the incident wave has a well-defined front, and that the transmitted disturbance due to an incident simple pulse is of the order of the reciprocal of the distance from the interface, when this distance is large. It is pointed out that the same analysis can be applied to the treatment of the total reflection of electromagnetic waves of arbitrary shape. Finally, the propagation of waves of arbitrary shape over the surface of a semi-infinite elastic solid is considered and shown to be possible when the velocity of propagation is that of Rayleigh waves.

A.

534.321.9 : 541.124

Chemical reactions produced by ultrasonic waves. See Abstr. 1542

534.852.3 : 778.534.4

1369. Basic characteristics of the transverse sound track. PARFENTIER, A. T. *J. Tech. Phys., USSR*, **17**, 1195–208 (Oct., 1947) *In Russian*.—The characteristics of the parameters of the photographic sound track are given and the laws connecting output, modulation factor and dynamic spectrum with the densities of the transparent and blackened parts of the phonogram are stated. The distortions due to photographic causes at high frequencies are considered next. The mathematical relations between output, the noise level of the thunder effect [Donnereffect], flicker factor [Klirrfaktor] and frequency are established. The optimum conditions to be maintained when taking transverse sound tracks are then found. A.

OPTICS . RADIATION . SPECTRA 535

535.231.4 : 536.46

1370. Emissivity of small particles in flames. WOLFHARD, H. G. AND PARKER, W. G. Letter in *Nature, Lond.*, **162**, 259 (Aug. 14, 1948).—The results of optical experiments on a stationary flame, 5–10 cm

diameter, of Al flakes in air are reported. The intensity distribution in the flame was unusual, the radiation consisting of weak AlO bands and a strong continuum extending from the red into the far ultraviolet. The colour temperature was about 3 600°C, but other tests gave the flame temperature as the boiling point of Al_2O_3 . It is suggested that small droplets, some smaller than the wavelength of light, of Al_2O_3 formed by condensation are the emitters and that their temperature is that of the gas. The abnormally high colour temperature is attributed to the optical properties of small particles. Mg is stated to behave similarly. S. W.

535.262 : 551.52

1371. A photometer for measurement of sky brightness near the sun. EVANS, J. W. *J. Opt. Soc. Amer.*, **38**, 1083–5 (Dec., 1948).—Measurement of the brightness of the sky near the sun is difficult because instrumental scattered light originating in the solar disc is usually many times brighter than light from the sky. An optical system for eliminating this scattered light and providing means for a visual photometric comparison between the sky and the sun has been constructed and tested. The principles of the instrument are explained in sufficient detail to permit the design of similar instruments for a wide range of applications. A.

535.231.4

1372. The emissivity of globar. SILVERMAN, S. *J. Opt. Soc. Amer.*, **38**, 989 (Nov., 1948).—Details are given of the emissivity of globar (for the region 1.5–15 μ), in connection with possible use as a comparison radiation standard. A. H.

535.247.4 : 621.383 : 522.615

An improvement in the use of photoelectric cells for stellar photometry. See Abstr. 1275

535.317

1373. A differential adjustment method of refining optical systems. STEMPER, W. M. *J. Opt. Soc. Amer.*, **38**, 935–53 (Nov., 1948).—It is assumed that a preliminary design of an optical system has been completed and the characteristic rays traced through it to determine the aberrations which afflict it. The present article then starts with these data and offers a set of reduction formulae. These formulae are applied, surface by surface, from the image space forward until any particular parameter is reached. This is done for every parameter in the system. These results are finally substituted in differentiated aberration formulae to give a coefficient which, when multiplied by the change in the parameter, gives the change in the aberration in the final image space. When these coefficients are calculated for all parameters and all aberrations and recorded in a table, say, with the aberrations across the top and the parameters down the side, the designer has a complete picture of the performance of that optical system. The table then enables him to quickly adjust all parameters so as to obtain the best results possible from the set-up as given. A.

535.317 : 535.317.1

1374. Notes on the $\cos^4$ law of illumination. REISS, M. *J. Opt. Soc. Amer.*, **38**, 980–6 (Nov., 1948).—The formulae for the distribution of illumination in the

focal plane of a lens system without and with distortion are derived. These formulae are applied to some extreme wide-angle lenses, and a numerical example is included. Special attention is given to the distortion of the pupils and the importance of stop position for illumination. The formula for the illumination distribution in a monocentric system is derived. A.

535.317.6 : 518.5

1375. Calculations of optical systems using the slide-rule. NAUMANN, H. *Optik*, 3 (Nos 5-6) 475-82 (1948) *In German*.—A 25 cm slide-rule, with reciprocal scale, has been used to compute the aberrations of an achromatic lens. From a comparison with 5 fig. log. calculations, it is concluded that sufficient accuracy is obtained for designing systems such as Galilean telescopes and for the preliminary design of more highly corrected systems. H. H. HOP.

535.317.6

1376. Automatic ray plotter. SCAIFE, F. N. *J. Sci. Instrum. Phys. Ind.*, 25, 384 (Nov., 1948).—For plotting the incident and refracted ray through media having refractive indices in the region 1.4-1.7, an instrument has been produced which makes use of a well-known geometrical construction and can be used to plot rays through blocks of refracting material, or to find focal points in much less time than would be required for hand plotting. A.

535.32 : 535.8 : 548.0

1377. The dispersion of the compound crystals TiBr-TiI (KRS 5) and TlCl-TlBr (KRS 6) in the infra-red. HETTNER, G. AND LEISEGANG, G. *Optik*, 3 (No. 4) 305-14 (June, 1948) *In German*.—Describes measurements of refractive index on these two substances in the ranges from the D-line to 32μ (for KRS 5) and to 24μ (for KRS 6). Values are given for close intervals of λ and to 4 places, and have ranges 2.6290-2.2914 (KRS 5) and 2.3367-2.0752 (KRS 6). See Abstr. 1428 (1949). H. H. HOP.

535.33 : 521.06 : 523.77 : 523.87

A study of four solar-type stars. See Abstr. 1296

535.33 : 523.77

Molecular CH bands in the solar spectrum. See Abstr. 1289

535.33 : 535.37

Emission spectra of mixed alkali halide phosphors. See Abstr. 1397

535.33.03 : 537.52

1378. Investigation of the "spark" after-effect and mutual influence of elements in quantitative spectral analysis. FILIMONOV, L. N. *Izv. Akad. Nauk, SSSR, Ser. Fiz.*, 12, 402-11. (July-Aug., 1948) *In Russian*.—Experimental investigations of the effects of spark discharges on steel alloys are described. About 100-300 partial condenser discharges occur per sec, each consisting of about 20 decaying oscillations. Eruptions of the electrode material in vapour form take place at the same time. The generation of oxide films and the subsequent chemical processes are described in detail; the films are shown to disappear and re-appear at the rate of up to 200/min. Two fundamental groups of oxide films are considered; those of alloys with a component of higher affinity to O than Fe, such as Al, Cr, Mn, Si and of other alloys

with constituents of lower affinity such as Cu and Ni; their behaviour and differences are described. Two "spark after-effect" curves are shown by plotting the difference in "blacking out" of Mn II and Fe II lines of Mn steel, and of Ni I and Fe I lines of Ni steel, vs. discharge time. Additional effects due to the presence of third elements in alloys are also investigated. A. L.

535.33.071 : 545.82 : 537.523

Spectroscopic study of copper in hydrogen. See Abstr. 1462

535.33.072

1379. A vacuum spectrograph for the infra-red. BADGER, R. M., ZUMWALT, L. R. AND GIGUÈRE, P. A. *Rev. Sci. Instrum.*, 19, 861-5 (Dec., 1948).—A description of a 1 m focus vacuum grating spectrometer for the infrared which is distinguished by its versatility and compactness of design. The vacuum container is tubular in form and all optical parts are mounted on a carriage which is readily retractable from the case for adjustment. A novel feature is the use of a sine screw drive which gives a linear wavelength scale. A representative spectrum tracing is given. A.

535.338.334 : 523.87

Lines in stellar spectra. See Abstr. 1297

535.339

1380. New prism autocollimator with spherical surfaces for use as a monochromator. DESVIGNES, F. *Rev. Opt. (Théor. Instrum.)* 27, 439-50 (July, 1948) *In French*.—A source is placed at one of the aplanatic points of a concave surface, and after refraction the light meets a spherical reflecting surface normally, the final image being in the same position as the source. The refraction being aberration-free, high apertures may be used giving higher dispersion and more critical isolation of wavelengths when selected by a small aperture moving longitudinally. The dispersive and photometric properties are discussed. In comparison with a prism monochromator, the present arrangement is simpler, has greater transmission and is freer from stray light. H. H. HOP.

535.339 : 535.243

1381. A double mirror-type monochromator for spectrophotometry and spectroenergetics. TERRIEN, J. AND DESVIGNES, F. *Rev. Opt. (Théor. Instrum.)* 27, 451-5 (July, 1948) *In French*.—The mirror optical parts in the apparatus are strictly achromatic. The apparatus can be adjusted by a single control for the desired wavelength with an accuracy of approx. $1\mu\mu$ in the centre of the spectrum. It is provided with glass prisms for the visible and adjacent regions, or with rocksalt prisms for the ultraviolet and infrared ($250-15\,000\mu\mu$), and is very easily transformed into a Van Cittert radiation mixer. F. L.

535.34 : 535.39

1382. Transmission of light by a system of alternate thin layers. ABELÈS, F. *C.R. Acad. Sci., Paris*, 226, 1808-10 (May 31, 1948) *In French*.—Media n_0, n_3 are separated by alternate thin films $n_1, n_2, n_1, n_2, \dots, n_1, n_2$, of equal thickness. Matrices represent each layer; c_1, c_2 being those of films n_1, n_2 . It is shown that $|\Gamma| = 1$, where $\Gamma = c_1 c_2$ no matter what the nature or thickness of the films or the angle of incidence or polarization of the wave. In this case

the specification of the films may be found using Chebichev polynomials, of which tables are available.

H. H. HOP.

535.34 : 535.61—15

1383. Infra-red absorption of deposited blacks. PLYLER, E. K. AND BALL, J. J. *J. Opt. Soc. Amer.*, **38**, 988 (Nov., 1948).—Infrared transmission measurements, up to $39\ \mu$, are made on Bi, C, Au and Zn blacks deposited on Ti (Br, I) windows, the results being presented graphically. The measurements show that Au black is well suited for coating receivers.

A. H.

535.342.35 : 539.132

1384. Ultraviolet absorption spectrum of HCl gas and the potential energy curve of the excited state of the HCl molecule. VODAR, M. B. *J. Phys. Radium (Sér. 8)* **9**, 166–8 (May, 1948) *In French*.—The variation of the molecular extinction coeff., ϵ , of pure HCl gas with frequency, ν , over the range 44 000 to 47 000 cm^{-1} is studied experimentally and theoretically. The specific absorption is independent of pressure and of temp. between -90 and $+20^\circ\text{C}$. The curve of $\log \epsilon$ against ν is a straight line. The potential energy curve for the excited state is deduced.

C. B. A.

535.343 : 535.37 : 536.48

1385. Absorption and luminescence spectra of uranyl salts at liquid helium temperature. SAMOILOV, B. N. *J. Exp. Theor. Phys., USSR*, **18** (No. 11) 1030–40 (1948) *In Russian*.—Five uranyl salts were investigated at a temperature of 4.2°K . Preliminary evidence was obtained for the polarized condition of the spectra of luminescence of two uranyl-acetates at the temperature of liquid air. A new polarization phenomenon was detected in the circular polarization of some lines of the luminescence spectrum of sodium-uranyl-acetate. In the absorption spectrum of the same salt lines with strong circular dichroism were established.

A.

535.343–15 : 539.13

1386. The infra-red spectrum and structure of aluminium trimethyl. PITZER, K. S. AND SHELINE, R. K. Letter in *J. Chem. Phys.*, **16**, 552–3 (May); erratum, 668 (July, 1948).—The spectrum from 440–820 cm^{-1} shows 4 intense Al–C stretching fundamentals. This supports bridged structures as opposed to ethane-like structures.

D. H. W.

535.343.2–15

1387. Absorption of magnesium oxide in the infra-red region. WILLMOTT, J. C. Letter in *Nature, Lond.*, **162**, 996 (Dec. 25, 1948).

535.345.6–31

1388. Transmission filters for the ultraviolet. KASHA, M. *J. Opt. Soc. Amer.*, **38**, 929–34 (Nov., 1948).—The problems involved in the development of ultraviolet transmission filters are discussed and criteria of stability, efficiency and ease of preparation are applied to the materials suggested by previous workers. By the selection of the most suitable previous filters and the introduction of several new filters, a set of band pass filters for the 2 400–3 800 Å region is developed. These have a $\frac{1}{2}$ -width of 200 Å and a maximum transmission of 30%, on the average. Quantitative spectrophotometric data are given for all

components and filter combinations used. Suggestions are made for the further development of these tools.

A.

535.345.6–31

1389. Short wave-length cut-off filters for the ultraviolet. BASS, A. M. *J. Opt. Soc. Amer.*, **38**, 977–9 (Nov., 1948).—A number of organic compounds have been investigated for possible use as short wavelength cut-off filters in connection with fluorescence studies in the near ultraviolet region (3 000–2 300 Å). The absorption of these filter compounds has been studied, in the pure liquid state and in iso-octane solutions of various concentrations, by means of a Beckman DU spectrophotometer. It was found that for a number of substances the cut-off wavelength can be shifted over a fairly wide range by varying the concentration of the solution. Curves are given for phenol, benzene, cumene and thiophene. A table lists the cut-off wavelengths for these compounds and also for chlorobenzene, dihydropyran and mesitylene.

A.

535.37

1390. On the intensity distribution in the visible region fluorescence band of cadmium vapour. KAPUSCIŃSKI, W. *Bull. Int. Acad. Polonaise Sci. Lett. A (Nos 4–10)* 159–67 (April–Dec., 1939) *In German*.—Saturated Cd vapour was excited at temps. ranging from 545° to 700°C by various wavelengths. The nature of the primary excitation has no perceivable effect on the intensity distribution of the fluorescence band between 5 100 and 3 900 Å, or on the position of the intensity maximum.

F. L.

535.37

1391. On various processes of irradiation of crystallophosphors. LEVSHIN, V. L. *Izv. Akad. Nauk, SSSR, Ser. Fiz.*, **12** (No. 3) 217–38 (1948) *In Russian*.—The luminescence of crystallophosphors due to small admixtures of heavy metal activators is discussed and the existence of different kinds of exciting radiation elucidated. Light is absorbed by the basic substance but is usually radiated by the activator. To explain the duration of luminescence the concept of electron levels is introduced, these being special places within the lattice beneath the zone of conductance at which electrons may be retained. The author describes experimental work from which he draws the following conclusions. The simplest mechanism in which the levels are supposed to be of one depth only cannot explain the phenomena observed in actual phosphors. The influence of levels of different depths and of several activators must be considered. The actual distribution of electrons between the levels depends on the experimental conditions and, with the total number of localized electrons, influences the kinetics of the process. Electrons at different levels have different possibilities of becoming released and recombined, hence the kinetics of the processes depend on the conditions of irradiation, whether thermal, optical or otherwise. The interaction of activators also affects the process. Various short-time processes of irradiation exist that differ in duration and origin: these are also described. Processes that differ in the time they occupy, e.g. luminescence in excitation or flash, involve several different mechanisms. The composition of these radiations is different in different phosphors. W. R. S.

535.37

1392. Duration of the initial luminescence process of phosphors. GALANIN, M. D. *Dokl. Akad. Nauk, SSSR*, **60** (No. 5) 783-4 (1948) *In Russian*.—The difference between flash-processes and long-lived effects in luminescence has long been established, and their observation has been carried through by different instruments, i.e. the phosphoroscope or the c.r.o. Yet there are flash-phenomena of so short a duration that the phosphoroscope cannot be used ($<10^{-5}$ sec). A special instrument, called "fluorometer," was designed to enable processes with a life-time of the excited states in dipole transitions of atoms and molecules of $\sim 10^{-8}$ sec to be investigated. This requires quartz optics. Phosphors of the composition $\text{ZnS} + \text{Mn}$, $\text{ZnS} + \text{Zn}$ and $\text{SrS} + \text{Ce}$ were used for obtaining the "fundamental fluorometric curve," i.e. the ratio of the intensities of the modulated and unmodulated light v. length of the optical path between first and second modulation, which for the phosphors investigated are very nearly horizontal straight lines. For the extinction period the following inequality holds: $\sqrt{(1 + \omega^2\tau^2)} > 15$, where ω is the cyclic frequency of modulation, τ the extinction period. It should be noted that in the given estimates of $\tau \sim 10^{-7}$ sec the background influence which tends to smooth out the modulation, has been neglected. It could be allowed for by a correction of $\sim 30\%$. The results may be interpreted as confirming that the duration of fluorescence flashes of the phosphors investigated exceeds the life-time of the excited molecular states.

B. F. K.

535.37

1393. Extinction of the phosphorescence of dye-stuff solutions by foreign matter. SVESHNIKOV, B. YA. *Dokl. Akad. Nauk, SSSR*, **60** (No. 5) 791-4 (1948) *In Russian*.—According to Terenin's hypothesis [*Acta Physio-Chim., URSS*, **18**, 210 (1943)] oxidation reactions are partly due to molecules in the metastable (bi-radical) state, and the activation energy would be required for the conversion of the molecule from the valency form into the bi-radical form. In the case of photo-oxidation the molecule falls from a higher, labile, level to the metastable level, whilst in thermal reactions the transition occurs from a normal level under the influence of energy absorbed in collisions. The strong effect of inhibitors on the photo-reactions seems to support this theory. The inhibitive action on fading of certain dyes of small additions of hydroquinone, resorcinol, aniline and KI are well known, and the necessary inhibitor concentration $\ll$ that required for appreciable extinction of luminescence. This proves that inhibitor action cannot consist in de-activation of excited molecules on the labile (fluorescence) level. On the other hand, a single extinction mechanism is suggested by the close connection frequently observed between photochemical and thermal reactions. The theories on extinction by foreign matter, on the other hand, have a highly artificial character and seem to contradict the principle of microscopic reversibility. These conflicting facts were subjected to a closer examination, the substance investigated being orange rhodulin, with hydroquinone and aniline as inhibitors, dissolved in glycerin with 2% $\text{C}_2\text{H}_5\text{OH}$ added. The measure-

ments were made with Becquerel's phosphoroscope. The results not only confirm the basic assumptions of Vavilov's extinction theory and Terenin's hypothesis that inhibitor action may be interpreted as de-activation of the metastable states of the molecules, but also provide weighty arguments in favour of theories suggesting that the rate of slow reactions in solutions is determined by diffusion. The application of this principle, clearly confirmed for extinction of the fluorescence of solutions, to thermal reactions is rendered difficult by the short life-time of molecular thermal-excited states. However, held together with the author's previous disclosure [*Dokl. Akad. Nauk*, **3**, 61 (1936)] that the kinetics of some thermal reactions may be taken as evidence of the possibility of excited states of much longer duration in solutions, and of the existence of bi-radical states whose energy differs comparatively little from that of the valency states, the above conclusion is made more convincing and concrete.

B. F. K.

535.37

1394. Thermal extinction of photo-luminescence of the sublimate-phosphor KI + Tl. SHALIMOVA, K. V. *J. Exp. Theor. Phys., USSR*, **18** (No. 11) 1045-8 (1948) *In Russian*.—On a specimen prepared in air, the process conformed to Mott's equation. The activation energy, U , depends on the wavelength of the exciting light and on the concentration of the activator; the higher the latter, the lower are the U values. The coefficient C indicating the bond of the admixture with the crystal lattice remains constant for all wavelengths of the exciting light at a given concentration of the activator, and decreases with rising activator concentration.

A.

535.37

1395. Optical properties of zinc fluoride phosphors. FONDA, G. R. AND STUDER, F. J. *J. Opt. Soc. Amer.*, **38**, 1007-14 (Dec., 1948).—When activated with Mn alone, ZnF_2 emits an orange fluorescence under excitation by 2 537 Å whose brightness is very weak because its peak excitation lies at 2 200 Å. Other activators, Ce, W and Ti, shift the peak excitation to 2 500-2 600 Å and produce a higher absorption in the range 2 000-2 600 Å. The emission of W and Ti lies mainly in the visible; that of Ce consists of a series of bands in the u.v. Combinations of these elements with Mn produce greater fluorescence brightness. With W or Ti, the normal orange emission of Mn is increased many times with no change in the spectral distribution nor in the unique exponential decay of its afterglow, except that the decay is raised to a higher brightness level. With Ce, the individual emission of each activator persists, with no reduction in intensity of the u.v. Ce bands and with only a slight increase in the intensity of the Mn band. As explanation of this apparent discrepancy, evidence was found that only W and Ti are present in the same phase as Mn, namely, ZnF_2 . Ce combines to form a separate phase, an aggregate of Zn and Ce fluorides.

A.

535.37

1396. Energy transfer in sensitized $\text{Ca}_3(\text{PO}_4)_2$ -Ce-Mn and CaSiO_3 -Pb-Mn. BOTDEN, TH. P. J. AND KRÖGER, F. A. *Physica, 's Grav.*, **14**, 553-66 (Dec., 1948) *In English*.—Calcium phosphate activated with Ce shows a u.v. emission consisting of 2 overlapping

bands, with maxima at approximately 3 470 Å and 3 660 Å, when excited by $\lambda < 3\,500$ Å in the absorption bands due to the Ce^{3+} ion. Calcium silicate activated with Pb shows a u.v. emission with maximum at 3 300 Å when excited by $\lambda < 2\,900$ Å in the absorption bands due to the Pb^{2+} ion. With Mn as a second activator, a large part of the absorbed energy in both phosphors is transferred from the Ce (or Pb) centres to the Mn centres. The fluorescence spectrum consists of a faint u.v. Ce (or Pb) emission and a strong orange-red Mn emission. The quantum efficiency of the red emission is about 55% for calcium phosphate activated with Ce and Mn and about 75% for calcium silicate activated with Pb and Mn. For both phosphors the quantum efficiency is nearly constant between the temperatures -150°C and $+250^\circ\text{C}$. The mechanism of excitation by u.v. is discussed. A.

535.37 : 535.33

1397. Emission spectra of mixed alkali halide phosphors. FIALKOVSKAYA, O. V. *Dokl. Akad. Nauk, SSSR*, **60** (No. 4) 475–8 (1948) *In Russian*.—The phosphorescence spectra of mixed crystals of various alkali halides activated with TlCl were investigated to find the effects of the various cations and anions in the crystal lattice. A phosphor obtained by mixing and subsequently fusing finely ground equimolecular amounts of KCl and KI with 0.5% TlCl showed two emission maxima (of $\text{KCl} + \text{TlCl}$ and $\text{KI} + \text{TlCl}$), while a phosphor prepared by simply mixing the same amounts of substances showed only one maximum (that of $\text{KI} + \text{TlCl}$, KI having the greater lattice constant of the two alkali halides). Because of greater or smaller differences in the lattices, very different effects have been observed in $\text{KCl} + \text{CsCl} + \text{TlCl}$ and $\text{KCl} + \text{RbCl} + \text{TlCl}$. The phosphorescence spectrum in a mixed crystal enables one to decide whether the system in question is a true mixed crystal or a mixture of crystals. F. L.

535.37 : 666.1

Fabrication of boric acid glass for luminescence studies. See Abstr. 1608

535.371

1398. Suppression of phosphorescence. II. Comparison of the effects of α -particles and pressure. BECKER, A. AND BECKER, F. *Ann. Phys., Lpz. (Folge 5)* **43** (No. 8) 598–606 (1943) *In German*.—Investigations into the suppression of luminescence of ZnS and ZnS/CdS phosphors when subjected to α -radiations or to pressure indicate that these are similar in effect. With all the Cu-activated phosphors investigated, the suppression produced by both methods is very marked, and is accompanied by a simultaneous reduction in the luminescence capacity. The latter is normally greater for exposure to pressure than to α -radiations, and the latter are therefore preferable for the evaluation of suppression effects in such cases. There are indications that similar effects are to be expected on exposure to other analogous radiations. The temp. coefficient of the 2 effects differs markedly, especially with Ag-activated phosphors, for which the effect of α -radiations is greater than that of pressure. J. G.

535.371

1399. Decay of luminescence and particle size of pressurized zinc sulphide phosphors. WECKER, F.

Ann. Phys., Lpz. (Folge 5) **43** (No. 8) 607–15 (1943) *In German*.— ZnS phosphors were subjected to a hydraulic pressure of about $4\,000\text{ kg/cm}^2$, and examined by sedimentation and microscopical methods. The results show a correspondence between particle size and the resulting decay in luminescence capacity. Fluorescence photomicrographs are reproduced. The pressurized phosphors show a larger proportion of relatively large particles having surface fissures, and these are regarded as playing a primary role in luminescence decay. The action of pressure reduced the luminescence capacity to 17.5, 11.5 and 1.5% of the original values for Riedel "Grun" coarse and fine phosphors and for a ZnS-Ag phosphor, respectively. On account of the high refractive index of ZnS , better microscopical results are obtained with an amorphous mixture of Se (60%) with S (40%). The effect of pressure is to displace the wavelengths of the luminescence towards the longer region. J. G.

535.371

1400. Theory of electron retrapping in phosphors. HERMAN, R. C., MEYER, C. F. AND HOPFIELD, H. S. *J. Opt. Soc. Amer.*, **38**, 999–1006 (Dec., 1948).—The set of non-linear differential equations that has generally been employed to describe the electron transfer processes in infrared phosphors has been solved by means of a differential analyser in the general case, and approximate solutions have been obtained for cases of practical interest. It is shown that the simultaneous measurement of the brightness and instantaneous photo-current in a phosphor stimulated by i.r. light allows a determination to be made of the ratio of the cross-sections for electron capture into empty trapping centres and into empty luminescent centres. This cross-section ratio can also be determined from measurements of the light sum and the maximum instantaneous photo-current. A.

535.372

1401. Transition probabilities for radiating and radiationless processes in crystalline $\text{Eu}_2(\text{SO}_4)_3 \cdot 8\text{H}_2\text{O}$. RINCK, B. *Z. Naturforsch.*, **3a**, 406–12 (July, 1948) *In German*.—Measurements by phosphoroscope of the decay of fluorescence after excitation by long u.v. waves, photographic determinations of the relative intensities of the 7 emission bands produced by transitions to the ground state ^7F , and known data on absorption of the salt are combined to calculate the transition probabilities. For radiating transitions to ^7F the values lie between 0.1 and 30 sec^{-1} ; for radiationless transitions from the excited state the probability is about $5\,300\text{ sec}^{-1}$. All but 1% of the transitions are radiationless in spite of the shielding of the 4f electrons. S. T. H.

535.375.5

1402. Raman spectra of germanium tetrachloride and lead tetrachloride. NEU, J. T. AND GWINN, W. D. *J. Amer. Chem. Soc.*, **70**, 3463–5 (Oct., 1948).—Re-examination of the Raman spectrum of GeCl_4 has confirmed that the value of ν_3 is 452 cm^{-1} . The deviation resulting from using this value in plotting metal-halide distance against Raman shift arises from the fact that in ν_3 the central atom is displaced as well as the Cl atoms; the mass effect thus introduced brings about the deviation. Plotting force constants against MCl distance gives smooth curves for each frequency

of the tetrahalides. PbCl_4 has frequencies of 327, 90 (or 85), 348, 90 (or 93) cm^{-1} .

W. R. A.

535.375.5 : 548.7

1403. Raman spectrum of a single crystal of $(\text{NH}_4)_2\text{H}_2\text{PO}_4$. CHAPEL, J. *C.R. Acad. Sci., Paris*, 226, 1814–15 (May 31, 1948) *In French*.—Ammonium phosphate belongs to the symmetry group S_6 , and the vibrations can be divided into the types A_1 , B_1 , B_2 , E. Specifying the binary axes by OX and OY, and the quaternary axis by OZ, the tensors are written down for the moment induced by the electric field of the incident radiation for the four types. If there is no coupling round a binary axis, the tensors for B_1 and B_2 are no longer different, and they merge into a term for type B. The corresponding tensors are also written down for another system of reference, in which OZ is still the quaternary axis, but OX_1 and OY_1 are bisectors of the angle XOY in the previous system. This allows depolarizations to be calculated for the 4 types of vibrations, and for the type B, for 6 different experimental cases, e.g. incident light along OY_1 , scattered light observed along OZ. These calculated depolarizations are then compared with those obtained experimentally, for 5 different Raman frequencies. As a result 342 and 926 cm^{-1} are classed as type A, 398 and 463 as type B, and 537 as type E.

A. C. M.

535.39

1404. The reflection and transmission of light by any system of parallel isotropic films. CROOK, A. W. *J. Opt. Soc. Amer.*, 38, 954–64 (Nov., 1948).—By consideration of the formulae for the reflection and transmission of up to 3 films, it has been possible to form a generalization for an arbitrary number of films. This generalization is stated as a simple rule whereby the expressions for the reflected and transmitted amplitudes can be readily formed in terms of the Fresnel coefficients of the various boundaries. The generalization is proved by induction. It is also shown that the solution of the problem by the consideration of the electromagnetic disturbance in each medium, and by the summation of multiple beams, lead to the same result.

A.

535.39 : 535.312 : 535.314

1405. Molecular theory of optical reflection and refraction. SIVUKHIN, D. V. *J. Exp. Theor. Phys., USSR*, 18 (No. 11) 976–94 (1948) *In Russian*.—The object of the investigation was to provide a theoretical explanation of the deviations from Fresnel's formulae observed in the reflection of light from "clean" surfaces. In the first part of the paper a quasi-microscopic treatment is used for deriving formulae for the reflection of light on an optically isotropic medium with an intermediate layer on its surface, the thickness of which $\ll$ the wavelength of the light. The formulae apply to macroscopic layers as well as to molecular (particularly mono-molecular) layers. In the second part the reflection from an optically isotropic, cubic crystal lattice, formed of "point" and isotropic atoms, is treated. The author supplements Ewald's well-known calculations by terms of the order a/λ and shows that the reflection from the lattice occurs as though it were a continuous medium with a continuous transition layer on its surface. The

calculation of the parameters $\gamma_x, \gamma_y, \gamma_z$ of the lattice is given; eventually the influence of lattice distortion at its boundary face on the reflection of light is considered.

A.

535.39 : 535.511

1406. Optical measurements of surface films. I. ROTHEN, A. AND HANSON, M. *Rev. Sci. Instrum.*, 19, 839–41 (Dec., 1948).—Practical information is given concerning the calibration of an instrument called the ellipsometer, which is used to measure thicknesses from 1 Å up to $\geq 1\,000$ Å of transparent films deposited on polished metal slides. It is a half-shadow instrument taking advantage of the ellipticity of polarized light reflected from film-coated metallic surfaces. The half-shadow is produced by depositing a different thickness of transparent material on the lower and upper part of the slides, or by evaporating a thin layer of Au directly on the lower part of Cr slides.

A.

535.39 : 539.211 : 539.238

1407. Optical determination of thin films on reflecting bases in transparent environments. WINTERBOTTOM, A. B. *J. Opt. Soc. Amer.*, 38, 1074–82 (Dec., 1948).—The classical theory of metal and film optics is recapitulated and its implications in connection with various optical methods of studying films and surfaces are indicated. The experimental technique of determination of thin films *in situ* from the change produced in the reflection of a polarized wave is then outlined. Optical techniques are not advocated to supplant other methods of studying surfaces such as weight increment, gas absorption, electron diffraction, X-ray diffraction and electrochemical analysis, but rather to supplement these in selected cases. In particular, the optical techniques are of value in making continuous studies of films *in situ* in transparent environments when conditions render the application of other methods difficult. Examples of applications are given.

A.

535.39–311

1408. Coefficients of reflection in the ultraviolet of magnesium carbonate and oxide. BENFORD, F., SCHWARZ, S. AND LLOYD, G. P. *J. Opt. Soc. Amer.*, 38, 964–5 (Nov., 1948).—The coefficients have been determined for 8 Hg lines in the ultraviolet. A spectrometer made up of a Rowland grating furnished a spectrum of light reflected from a part-sphere of the material under test. A photo-multiplier tube received the spectrum. The materials are both good reflectors, the oxide being especially good since it is over 0.90 at all points tested.

A.

535.4 : 535.82

1409. On the theory of image formation in the microscope. BEREK, M. *Optik*, 3 (No. 4) 289–97 (1948) *In German*.—A development of earlier work. An expression is derived for the amplitude function of the disturbance proceeding from an isolated inhomogeneity when illuminated obliquely by a linearly polarized plane wave.

H. H. HOPF.

535.41

1410. Experiments on standing light waves. THORWART, W. *Optik*, 3 (No. 3) 260–5 (1948) *In German*.—A repetition of Jäger's experiment, using an improved photo-electric probe of Al together with a mirror of Al.

H. H. HOPF.

535.412
1411. New localized interference fringes. TOLANSKY, S. AND BARAKAT, N. *Nature, Lond.*, **162**, 816–17 (Nov. 20, 1948).—A sheet of flexible transparent material silvered on both sides is shown to give rise to localized fringes, which are straight or circular according as the sheet is made to form a cylinder or a sphere. The radius must be short (1–5 cm). Fringes may be formed both by transmitted and reflected light. In the latter case good fringes may be obtained without silvering. In each case the fringes appear in a plane through the centre of curvature of the bent sheet.

H. H. HOP.

535.417 : 535.312.2
1412. Theory of the corner-cube interferometer. PECK, E. R. *J. Opt. Soc. Amer.*, **38**, 1015–24 (Dec., 1948).—The corner-cube interferometer [Abstr. 1215 (1948)] is analysed geometrically and analytically. When the prisms are used near their axis, the instrument is found to behave essentially like an interferometer using triple sets of front-surface mirrors. Equations are obtained describing the fringe patterns when one prism is used far off its axis, and also when both are used near their axis. These fringe patterns are discussed and illustrated.

A.

535.42
1413. A new formula for the calculation of diffraction phenomena. DURAND, E. *C.R. Acad. Sci., Paris*, **226**, 1812–14 (May 31, 1948) *In French*.—A representation of Kirchhoff's integral based upon the superposition of two sets of monochromatic plane waves. An advantage is claimed in that the formula permits easy passage from Fresnel to Fraunhofer diffraction problems.

H. H. HOP.

535.421
1414. Diffraction effects with optical gratings according to intensity and phase. MENZEL, C. AND MENZEL, E. *Optik*, **3** (No. 3) 247–59 (1948) *In German*.—A periodic one-dimensional absorption grating is represented by a Fourier expansion. Amplitude and intensity distributions are considered for separate sine and cosine terms, and the distributions for the grating itself obtained by addition. It is shown how a phase grating can be looked upon as 2 superposed amplitude gratings.

H. H. HOP.

535.421
1415. On the theory of imperfect diffraction gratings. FANO, U. *J. Opt. Soc. Amer.*, **38**, 921–9 (Nov., 1948).—The "dynamical" theory of gratings originally developed by Rayleigh and Voigt is applied to derive the intensity of the light diffracted in various directions by an imperfect grating of finite area. The problem is reduced to the numerical solution of a system of linear equations by an approximation method in which "ghosts" and high order spectra are treated as perturbations of the main spectra. Current elementary theories are then seen to yield merely order of magnitude estimates of the intensity of the ghosts caused by various grating imperfections.

A.

535.421 : 534.321.9
1416. Diffraction of light by very high frequency ultrasonic waves: effect of tilting the wave front. BHAGAVANTAM, S. AND RAMACHANDRA RAO, B. *Proc. Indian Acad. Sci. A*, **28**, 54–62 (Aug., 1948).—

Diffraction of light by ultrasonic waves of frequencies 25, 50·36, 102·6 and 177·2 Mc/s set up in H₂O has been studied, particularly with regard to the effect of tilting the wave front. First order diffraction predominates at moderately high frequencies (50 Mc/s) and higher orders are suppressed. At higher frequencies even first order lines are suppressed unless the wave front is tilted through an angle (on the appropriate side) equal to the Bragg reflection angle. [See Abstr. 1195 (1947)].

W. R. A.

535.424 : 535.317.1
1417. Diffraction and optical image formation. ZERNICKE, F. *Proc. Phys. Soc., Lond.*, **61**, 158–64 (Aug., 1948).—A review of earlier work dealing with the coherent background, the degree of coherence and the diffraction theory of aberrations.

H. H. HOP.

535.43
1418. Errata: New contributions to the optics of intensely light-scattering materials. I. KUBELKA, P. *J. Opt. Soc. Amer.*, **38**, 1067 (Dec., 1948).—See Abstr. 2435 (1948).

535.43 : 535.375.5 : 666

1419. Light scattering in optical glass. RANK, D. H. AND DOUGLAS, A. E. *J. Opt. Soc. Amer.*, **38**, 966–70 (Nov., 1948).—Raman spectra of two optical glasses (a borosilicate crown and a dense flint glass) have been obtained making use of unpolarized exciting light and also with parallel and perpendicular plane-polarized exciting light. These spectra consist essentially of continua with broad maxima in the continua. The main features are strongly polarized. With parallel polarized exciting light, a very strong depolarized line only 30 cm⁻¹ frequency shift from the exciting line appears in the flint glass spectrum. An attempt has been made to find modified Brillouin components in the Rayleigh line. Photographs of $\lambda 4047$ and $\lambda 4078$ made in the 3rd order of a 21-ft concave grating show no modified Brillouin components which are 1/100 as strong as the unmodified line. The polarization of the Rayleigh scattering of these glasses has been investigated. The intensities of the polarized components were measured by means of photo-electric methods. Measurements made with polarized exciting light show definitely that ρ_h is somewhat < 1, which definitely verifies the existence of a Krishnan effect in these glasses.

A.

535.43 : 535.81
1420. Study of the light diffracted by inhomogeneities in optical instruments. FRANÇON, M. *Rev. Opt. (Théor. Instrum.)*, **27**, 595–610 (Oct., 1948) *In French*.—A vein in the glass of a lens component is regarded as a thin cylinder of width a and length D , having a refractive index differing slightly from that of the surrounding glass. The phase variation impressed upon an image-forming wave-front is then written $\Phi = \phi/2(1 + \cos 2\pi x/a)$. The diffraction image is found to have a diametral line of constant (and appreciable) intensity. The intensity at any point in the pattern is evaluated in a series of Bessel functions. The max. path difference introduced by the vein is ϕ , and this must be $\leq \lambda/6$ if the loss in flux from the central disc is equal to that permissible with spherical aberration and low contrast test-objects. The effects of a vein are shown to be very serious in cases where a bright and weak source are imaged

simultaneously. In such cases the tolerance may be of the order of $\lambda/180$. The effect has been studied experimentally, and the treatment applied to a coronagraph.

H. H. HOP.

535.5 : 535.82

1421. Phase-contrast in polarised light. MONTAMAL, R. *Rev. Opt. (Théor. Instrum.)* **27**, 477-92 (Aug.-Sept., 1948) *In French*.—A $\lambda/4$ plate is cut and recombined to provide a central strip with its axes perpendicular to those of the remainder of the plate. The slit source is imaged on this strip. Alternatively, a $\lambda/2$ plate may be cut and used in conjunction with an uncut $\lambda/4$ plate. An analyser enables the amplitude of the direct light to be varied. A method is described whereby two suitably chosen wavelengths may be used simultaneously.

H. H. HOP.

535.515

1422. Analytical determination of the two refracted rays corresponding to a given incident ray in a birefringent crystal. SPIZUOCO, C. *Atti. Fond. Giorgio Ronchi*, **3**, 18-21 (Feb.-April, 1948) *In Italian*.—A straightforward application of 3-dimensional co-ordinate geometry.

H. H. HOP.

535.515 : 537.228.314 : 538.61

1423. Enforced anisotropy. STARIKIN, Y. A. Letter in *J. Exp. Theor. Phys., USSR*, **18** (No. 12) 1144-5 (1948) *In Russian*.—An external electric or magnetic field acting on an optically isotropic medium may produce artificial anisotropy in the latter, as experimentally verifiable (Faraday and Cotton-Mouton effects for the magnetic, Kerr effect for the electric case). The general theory of the enforced anisotropy is to be found in Born's textbook of Optics. However, the given derivation being very involved and not free from errors, a simplified and amended version of it is presented by the writer.

B. F. K.

535.55 : 539.37 : 532.51

Flow birefringence in suspensions of deformable particles. See Abstr. 1336-8

535.6 : 551.593.62

1424. Colours of rainbows and mistbows. BUCHWALD, G. *Optik*, **3** (Nos 1-2) 4-13 (1948) *In German*.—Triangular plotting is used to investigate the sensations produced by rainbow colours, basing the effects on the International Three-Colour system.

W. A. R.

535.642

1425. Distribution coefficients for the calculation of colours in the C.I.E. trichromatic system for a total radiator at 2450°K. HIRD, S. A. E. AND STEPHENSON, H. F. *Proc. Phys. Soc., Lond.*, **61**, 198-9 (Aug., 1948).

535.8

1426. The design of triplet anastigmat lenses of the Taylor type. STEPHENS, R. E. *J. Opt. Soc. Amer.*, **38**, 1032-9 (Dec., 1948).—Equations and methods are developed for computing the lens powers, separations and lens shapes of preliminary thin lens designs of Taylor-type triplets. The 3 lens powers and 2 spaces are determined by specified values of equivalent power, Petzval sum, longitudinal chromatic aberration, lateral chromatic aberration and spherical aberration. The 3 lens shapes are determined by desired values of the 3 Seidel sums relating to coma, astigmatism and

distortion. Procedures for replacement of thin lenses by equivalent thick lenses and for final trigonometric adjustment are outlined. The methods given are not limited to the case of the infinitely distant object, but may be used to determine a system for any specified magnification and having any moderate values of the 8 independent variables.

A.

535.8 : 771.351

1427. Photographic sharpness and resolving power. I. The design and performance of an apochromatic resolving-power camera objective. PERRIN, F. H. AND HOADLEY, H. O. *J. Opt. Soc. Amer.*, **38**, 1040-53 (Dec., 1948).—The excessive residual aberrations of the ordinary achromatic doublet that had been regularly used to photograph resolving-power test objects on film samples led to the construction of a special air-spaced apochromatic triplet containing fluorite. So excellent is the correction of the new lens that the Airy disc is white and changing the focus setting to fit the spectral sensitivity of the sample is unnecessary, except when the sensitivity peak is at a wavelength longer than 580 m μ . The improvement in measured resolving power over the values obtained with the former lens is slight for materials of high resolution but is marked for materials whose values are below about 100 lines/mm. Curves are presented showing the effect on resolving power of stopping down the new objective, and it is shown that this lens, whose aperture is $f/5$, is not adequate for materials exceeding 150 lines/mm or so, failing simply because of its comparatively low aperture. These results emphasize the dependence of resolving-power values on the aperture and the corrections of the camera lens. The loss in the resolving power of this lens caused by mal-focusing is also compared with that of an anastigmatic photographic objective.

A.

535.81

1428. Optical constructional materials of binary compound crystal systems. KOOPS, R. *Optik*, **3** (No. 4) 298-304 (1948) *In German*.—A substance was sought to fulfil the following: (1) transparency in far infrared, (2) isotropy, (3) resistance to H₂O, (4) ability to be polished. (1) requires large ions and small lattice energy, whereas (2) requires a hard substance with greater lattice energy, hence binary crystal systems were investigated. Of a number so found, the most suitable was the mixture: 44% TiBr and 56% TiI. This substance has been used to make a variety of optical components. [See Abstr. 1377 (1949)].

H. H. HOP.

535.81 : 539.23

1429. Chemical durability, specular gloss, and transmittance of optical glasses. HUBBARD, D. AND RYNDERS, G. F. *J. Res. Nat. Bur. Stand., Wash.*, **41**, 447-82 (Nov., 1948).—The chemical durability of 3 types of optical glass (BSC 517, BaC 572 and F 620) and chemical Pyrex have been studied over an extended pH range by means of an interferometer procedure. The accompanying effect on the appearance (gloss retained) and on the transmittance of the specimens has also been determined. The results illustrate the confusion that might arise from choosing any of the above 3 properties as an indicator for the serviceability of optical glasses. Below pH 6, in the range of maximum durability for the optical glasses, differential

solution of the alkali and heavy metal oxides brings about the formation of silica-rich, reflection-reducing films, which decrease specular gloss of the surface and improve the transmittance of the specimens. A.

535.81 : 539.32

Elastic constants of optical glasses. See Abstr. 1541

535.82 : 535.5

1430. New polarising microscope working in convergent light down to a temperature of about -150° . BOUTTIER, L. *C.R. Acad. Sci., Paris*, **227**, 1084-6 (March 22, 1948) *In French*.—A simple uncorrected microscope for use in the study of crystallization at low temperature. Optically the device uses only two single lenses and an Abbe condenser, together with analyser and polarizer. Alcohol can be used as an immersion fluid. H. H. HOP.

535.88

1431. On the calculation of the illumination produced by a projector. DUNOYER, L. *Rev. Opt. (Théor. Instrum.)* **27**, 399-425 (July, 1948) *In French*.—A detailed review of the classical and Blondel-Lavanchy theories. The latter still contains an apparent paradox which is removed by the more complete treatment given here. H. H. HOP.

HEAT 536

536.255

1432. Thermal conduction by contact in a layer of spherical particles. MULLOKANDOV, R. N. *J. Tech. Phys., USSR*, **17** (No. 10) 1149-52 (Oct., 1947) *In Russian*.—As the number of contact points between the particles decreases with increasing particle diameter, true contact conductivity between the particles would be revealed by the fact that the central zone of a particle layer cools off the quicker, the smaller the particle size. Yet the experiment shows a slight slowing down of cooling effect with decreasing particle size. This proves the convective character of the thermal conductivity in such layers, due to temperature differences between the air surrounding the individual particles and the particle surface. It seems that the actual contact conductivity is negligibly small. The conductivity in presence of a forced air current through the layer therefore has the direction of this current. A layer of smooth spherical particles in vacuum may be used as a good thermal insulator. A.

536.4.032.2

1433. Supercooling of mercury. CARPENTER, L. G., CONNELL, L. J. C. AND OSBORN, A. B. Letter in *Nature, Lond.*, **163**, 23 (Jan. 1, 1949).—Results of observations on Hg of high purity distilled *in vacuo* into twin pyrex vessels are briefly described. The amount of supercooling, ΔT_f , in air was $\sim 1^{\circ}\text{C}$, but *in vacuo* this could be increased by pre-heating to $>12^{\circ}\text{C}$. Change of atmosphere above the mercury affected ΔT_f , but not immediately. Vibration or bumping of the apparatus did not induce freezing. S. W.

536.46 : 535.231.4

Emissivity of small particles in flames. See Abstr.

536.46 : 536.3 : 621.45

1434. Radiation from rocket flames and its effect on rocket performance. PENNER, S. S. *Amer. J. Phys.*, **16**, 475-83 (Dec., 1948).—See Abstr. 3307 (1948).

536.46 : 541.126 : 542.943

1435. The third symposium on combustion, flame and explosion phenomena. WHITTINGHAM, G. *Fuel*, **28**, 12-18 (Jan., 1949).—A review of some of the more than 100 papers read at University of Wisconsin in Sept., 1948.

536.483

1436. The design of metal vacuum siphons for low temperature liquids. JONES, G. O. AND LARSEN, A. H. *J. Sci. Instrum. Phys. Ind.*, **25**, 375-7 (Nov., 1948).—Details are given of the design and method of fabrication of double-walled permanently evacuated metal siphons suitable for carrying liquid air, liquid H, etc. When properly constructed these siphons require no attention and can be used as standard elements in low-temperature plant, using ordinary "petrol unions" for making connections between siphons. The loss of liquid due to heat influx across the vacuum space is very low. Even with a clearance of only a few mm between the two tubes making up a siphon the outer wall remains only a few degrees below room temperature during use. A.

536.483 : 533.24

1437. A Simon-type helium liquefier with transfer siphon. SCOTT, R. B. AND COOK, J. W. *Rev. Sci. Instrum.*, **19**, 889-94 (Dec., 1948).—A helium liquefier utilizing the Simon expansion process is described. It is provided with a transfer siphon, so that the liquid produced is delivered into an external cryostat. By locating the expansion valve at the end of the transfer siphon, the cold gas released during the expansion is utilized in precooling the receiver, so that rather high yields are obtained. From the expansion chamber of 400 cm³ capacity, 310 cm³ of liquid are collected in the receiver. A.

536.51 : 551.508 : 551.524

Measuring air temperature on a high-speed airplane. See Abstr. 1595

536.531 : 537.311.33 : 621.317.39

1438. Temperature measurement by semi-conductor resistance thermometers. KOLOMIETS, B. T. AND SHEFTEL, I. T. *J. Tech. Phys., USSR*, **17**, 1105-10 (Oct., 1947) *In Russian*.—Resistance-temperature characteristics are given for UO₂ over the range 0-100°C. Thermistor resistance thermometer elements are described and rate of response demonstrated. Sensitivity and scale distribution are tabulated for various temperature ranges, obtained in conjunction with the usual bridge circuit. E. R. A.

THERMODYNAMICS 536.7/8

536.71

1439. Table and Mollier chart for ammonia below -60°F . MEYERS, C. H. *Circ. Nat. Bur. Stand.* **C472**, 3 pp. (1948).—A table of thermodynamic properties of saturated NH₃ vapour and liquid below -60°F , and a Mollier chart for saturated and for superheated NH₃ vapour covering the pressure range 0.8

to 5 lb/in². These data are based on National Bureau of Standards Circular C142 but are extensions of it to lower temperatures and pressures, terminating at the triple point of NH₃ (−107.86°K, 0.878 lb/in²). A.

536.71

1440. Compilation of thermal properties of hydrogen in its various isotropic and ortho-para modifications. WOOLLEY, H. W., SCOTT, R. B. AND BRICKWEDDE, F. G. *J. Res. Nat. Bur. Stand., Wash.*, **41**, 379–475 (Nov., 1948).—Available thermal data for H₂, HD and D₂ in solid, liquid and gaseous states are given, together with the properties of ortho and para forms of H₂ and D₂. The data include thermodynamic functions for the ideal gas state, equilibrium constants, data of state, viscosity and thermal conductivity with dependence on the pressure, vapour pressure, solid-liquid equilibria, specific heats and latent heats. Values of state derivatives useful in thermodynamic calculations have been given for normal H₂, and the related differences between thermodynamic functions for real and ideal gas states have been evaluated. A temperature-entropy diagram for normal H₂ in the range of experimental data is also given. The compiled thermal properties are presented in 38 tables, 33 graphs and numerous equations. 181 references are given. A.

536.71 : 536.48 : 532.7

1441. Quantum theory of condensed permanent gases. III. The equation of state of liquids. DE BOER, J. AND LUNBECK, R. J. *Physica, 's Grav.*, **14**, 520–9 (Dec., 1948) *In English*.—The equation of state for liquified permanent and noble gases is discussed from the point of view of the law of corresponding states using molecular units, as developed in a previous paper [Abstr. 2460 (1948)]. The deviations from the law of corresponding states, which are caused by quantum effects, are evaluated theoretically, using the method of Kirkwood and Slater. The results of the numerical calculations are compared with the experimental data. A.

ELECTRICITY 537

THEORY . ELECTRONS 537.1

537.12 : 538.1 : 530.145

Theory of the Dirac electron in a magnetic field. See Abstr. 1312

537.122

1442. Radiation of an electron moving in a circular orbit in a space bounded by metal walls. LEVIN, M. L. *J. Tech. Phys., USSR*, **17**, 1159–64 (Oct., 1947) *In Russian*.—The radiation of an electron uniformly moving in a circular orbit is considered, (1) within an ideally conducting tube of circular cross-section, the orbit lying concentrically in the plane of the cross-section, and (2) between two ideally conducting planes, the orbit in a plane equidistant from the conducting planes. An expression for the energy radiated in the *n*-th harmonic is given. A.

ELECTROSTATICS . DIELECTRICS 537.2

537.226 : 548.0 : 537

1443. Dielectric losses in optically-excited crystals. SIKORSKY, Y. A. *Dokl. Akad. Nauk, SSSR*, **60** (No. 1) 47–8 (1948) *In Russian*.—Experiments on the dielectric losses in additively coloured KI crystals indicate an increase during excitation by white light, which does not appear due to an increase in conductivity but more probably to a change in the internal stresses in the lattice. In mixed crystals with different lattice parameters the presence of localized internal stresses may be expected, the study of which may elucidate the nature of dielectric losses generally. L. J. G.

537.226 : 548.7 : 535.32

1444. Application of the Lorentz-Lorenz equation to crystals. BARBARON, M. *C.R. Acad. Sci., Paris*, **226**, 1810–12 (May 31, 1948) *In French*.—General arguments indicate that it is justifiable to apply the Lorentz-Lorenz equation even to an anisotropic crystal, the required modification being in the polarizability rather than in the form of the internal field. D. H. W.

537.226 : 548.7

1445. On a generalization of the Lorentz-Lorenz formula. VAN SANTEN, J. H. AND OPECHOWSKI, W. *Physica, 's Grav.*, **14**, 545–52 (Dec., 1948) *In English*.—The well-known Lorentz-Lorenz formula holds only for a crystal in which all atoms have environments with cubic symmetry. In this paper a derivation is given of an analogous formula, valid for the more general case that the environments of atoms are not necessarily cubic, the macroscopic symmetry of the crystal being still cubic. The formula is applied to the perovskite lattice. A.

537.226.1 : 621.315.6.011.5

1446. Physical properties of substances of high permittivity. *Nature, Lond.*, **162**, 245–7 (Aug. 14, 1948).—An account of a symposium on ferro-electric materials held by the Electronics Group of the Institute of Physics. Three papers were presented, followed by a discussion. Daniel, V., gave a survey of the electrical and crystallographic background of ferro-electricity. Rushman, D. F., discussed the high permittivity titanates, and the experimental evidence which establishes the ferro-electric character of Ba titanate and some of its solid solutions with other titanates. Devonshire, A. S., dealt with the theory of dielectrics and ferro-electricity, and described some original theoretical work on the spontaneous polarization of Ba titanate. E. R.

537.226.2

1447. Dielectric relaxation-times of solid solutions of aliphatic long-chain esters and ketones in paraffin wax and *n*-hexacosane. MEAKINS, R. J. Letter in *Nature, Lond.*, **162**, 994–5 (Dec. 25, 1948).—Room temp. measurements of relaxation-times of certain long-chain esters and ketones in both paraffin wax and *n*-hexacosane (C₂₆H₅₄) as the non-polar medium are described. Results indicate that Fröhlich's model [Abstr. 1196 B (1941)] in which the polar molecules enter the crystal structure by replacing hydrocarbon molecules, applies exactly to solid solutions of this type in pure hydrocarbons. C. A. H.

537.228.1 : 548.0 : 621.392.52

1448. E.D.T. and D.K.T. crystals for carrier channel filters. MASON, W. P. *Bell Lab. Rec.*, **26**, 222-5 (May, 1948).—Certain plates of ethylene diamine and potassium tartrates have very small variation of resonant frequency with temperature, and crystals of these substances are now being grown for commercial use in carrier telephony. Some orientations are unsuitable because of unwanted modes of vibration at frequencies near that of the wanted mode. P. O.

ELECTRIC CONDUCTION : CURRENTS 537.3

537.311 : 537.312.62

1449. A new picture of the mechanism of conduction in metals. KOCH, K. M. *Öst. Ingen. Arch.*, **2**, 363-72 (Sept., 1938) *In German*.—A modification of the electron gas theory is discussed. It is shown how in full analogy with ferromagnetism normal conduction and superconduction can be attributed to a common mechanism whereby the appearance of superconduction can be deduced from a universal tendency of the lattice of solids to increase progressively its state of order. H. G. S.

537.311 : 621.355.035.222.4 : 621.315.5

1450. The electrical conductivity of lead dioxide. THOMAS, U. B. *J. Electrochem. Soc.*, **94**, 42-9 (Aug., 1948).—The conductivity was measured for dense samples prepared by the electrolysis of Pb perchlorate and other Pb salts and for porous samples prepared from storage battery oxides and from pressed powder. The specific resistance of the dense samples is of the order of $2 \times 10^{-4} \Omega \text{ cm}$. That of the battery material is $74 \times 10^{-4} \Omega \text{ cm}$. The resistance increases with temp. by about 0.2%/deg c at room temp. A mechanism for conduction is proposed which assumes that PbO_2 is not of exact stoichiometric composition, but contains an excess of Pb, which is considered to be dissociated into tetravalent Pb ions and free electrons. The conductivity is due to the latter. Hall effect measurements have been made from which the density of carriers is shown to be about $4.4 \times 10^{20}/\text{cm}^3$ or 1.8×10^{-2} carriers per molecule. A.

537.311.1 : 532.782

1451. On the theory of the electrical resistance of metallic solid solutions. LINDE, J. O. *Ark. Mat. Astr. Fys.*, **36 A (Paper 10)** 22 pp. (1948) *In English*.—Formulae for the electrical resistance of metallic solid solutions are derived and compared with experimental results. It is assumed that there are two scattering processes for the conducting electrons: (1) ordinary scattering characterized by a decrease of scattering with increasing electron velocity u , and (2) extraordinary scattering resulting in an increase of scattering with increasing u . The former process occurs mainly in alloys with the b elements. The second process is assumed to dominate in certain alloys with transition metals as solutes. F. L.

537.311.33 : 621.315.59

1452. Properties of the badly conducting layers between metal and semi-conductor. LASHKAREV, V. E. *J. Tech. Phys.*, *USSR*, **18 (No. 11)** 1347-55 (1948) *In*

Russian.—Rectifying and capacitive properties are considered of an atomic layer between metal and semi-conductor, as well as its role in producing a photo-e.m.f. It is shown that the given theory is accurate in describing all the characteristics of Ag_2S photo-cells. The capacitive properties of the insulating layer between metal and semi-conductor are also considered. A.

537.312.5 : 537.311.33

1453. "Longitudinal" photo-conductivity of semi-conductors. LASHKAREV, V. E. *J. Exp. Theor. Phys.*, *USSR*, **18 (No. 11)** 953-61 (1948) *In Russian*.—The photo-conductivity of a hole-type semi-conductor is treated in a linear approximation for the case of parallelity or anti-parallelity of gradient of light and electric field. The specimen is irradiated through a semi-transparent electrode. Formulae are obtained applying to the case of an anti-barrier contact layer within which the light is totally absorbed. A.

537.312.5 : 537.311.33

1454. "Longitudinal" photo-conductivity and photo-e.m.f.'s in copper oxide. LASHKAREV, V. E. AND KOSSONOGOVA, K. M. *J. Exp. Theor. Phys.*, *USSR*, **18 (No. 11)** 962-9 (1948) *In Russian*.—The photo-conductivity of Cu_2O specimens was investigated through a semi-transparent electrode, i.e. along the electric field ("longitudinal" photocond.) The specimens under test showed +ve photo-e.m.f. It was shown that the photo-conductivity may be resolved into two components, one that is rectified by the field and one that is not. In the former the existence of a saturation current was found. The experimental results agree with the theory developed by one of the authors [preceding abstract]. Comparison with the theory permitted of estimating the displacement by diffusion of the photo-electrons and their life-time in the free state. A.

537.312.62

1455. The speed of transition from the normal to the superconducting state. ALEXEYEVSKI, N. E. *Dokl. Akad. Nauk, SSSR*, **60 (No. 1)** 37-9 (1948) *In Russian*.—The transition of a cylindrical Sn rod in a longitudinal magnetic field from the normal to the superconducting state for lowering of temp. and vice versa was studied by observing oscillographically the e.m.f. in a search coil round the specimen. On the assumption that the transition takes place by radial movement of a boundary between the phases, velocities of order 1 mm/sec were deduced, but probably a new kind of intermediate state is involved in the transition. D. S.

537.312.62 : 536.48

1456. Investigation of the forces required for displacing the boundary between superconducting and normal phases. TUMANOV, K. A. AND SHARVIN, Y. V. Letter in *J. Exp. Theor. Phys.*, *USSR*, **18 (No. 11)** 1056 (1948) *In Russian*.—It was attempted to measure the moment of the forces acting on a sphere in the intermediate state during its rotation relative to an external magnetic field. A Sn-spherule of 8 mm dia. was suspended in a Dewar vessel on what essentially corresponded to a torsion balance and deflected against the direction of the applied magnetic field. The tests were made at temperatures between 3.35°K and 2.67°K, and at values of the magn. field up to

102 oersted. Whilst up to a certain point there was proportionality between angle of deflection and deflecting moment, after passing the said point the spherule started creeping back-towards the side of lower moments. Although all kinds of experimental curves were taken, no simple relationship between any two parameters could be established. It was possible to measure the maximum magnetic moment exerted on the sphere for any temperature produced, but again it proved impossible to correlate these measurements in any way to those of the first series. The explanation offered is that the whole system is in an unbalanced state and that the time for establishing equilibrium is ≥ 1 hr.

B. F. K.

537.312.62 : 538.12

1457. Penetration depth of magnetic fields into massive superconductors. SHALNIKOV, A. I. AND SHARVIN, Y. V. *J. Exp. Theor. Phys., USSR*, **18**, 102-3 (Jan., 1948) *In Russian*.—A preliminary account of experiments dealt with in abstract below.

D. S.

537.312.62 : 538.12

1458. Investigation of penetration depth of magnetic fields into massive superconductors. SHALNIKOV, A. I. AND SHARVIN, Y. V. *Izv. Akad. Nauk, SSSR, Ser. Fiz.*, **12** (No. 3) 195-215 (1948) *In Russian*.—The temp. derivation of the penetration depth of a constant magnetic field into a spectroscopically pure Sn ellipsoid in the superconducting state is measured by the e.m.f. induced in a surrounding coil when the temp. is periodically varied 4 times per second. The temperature derivation is found to be $5.6 \times 10^{-6} \times (3.715 - T)^{-3/2}$ close to the transition temperature (3.715°K), and the penetration depth itself is deduced by integration of the experimental data. The values found are appreciably higher than those of Pippard [Abstr. 3543 (1947)] and of Laurmann and Shoenberg [Abstr. 973 (1948)]. It is suggested that this may be due to differences of surface conditions.

D. S.

537.312.62 : 538.56.029.6

1459. Super-conductivity at a frequency of 1.8×10^{10} c/s. GALKIN, A. A. AND LAZAREV, B. G. Letter in *J. Exp. Theor. Phys., USSR*, **18** (No. 12) 1145-6 (1948) *In Russian*.—Measurements were made with a short-wave magnetron and closed waveguide at liquid He temperature. The waveguide had a reflecting Sn wire grid a few cm from its closed end and the detector was placed in the voltage anti-node in the uncooled part of the waveguide. At temperatures $< T_{\text{crit}}$ the application of a longitudinal (i.e. || Sn-wires) magnetic field of super-critical strength leads to an $\sim 5\%$ lowering of the detector voltage. Above T_{crit} or below H_{crit} the magnetic field has no influence. The strength of the magnetic field and the occurrence of the effect coincide with the critical fields for Sn. For a transverse field the effect is delayed owing to an intermediate state being produced. The applied frequency of 1.8×10^{10} c/s is thus found not to be the critical one for Sn which at this frequency exhibited a difference in its reflecting properties, corresponding to the conversion from the superconducting into the normal state initiated by the magnetic field.

B. F. K.

537.324

1460. A method of constructing Cu-constantan thermocouples. CARTER, H. J. Note in *Rev. Sci.*

Instrum., 917-18 (Dec., 1948).—The junction is at an end-to-end joint, and the wires are held in position by a thin Cu sleeve, about 1 mm long, deposited electrolytically. Wires 0.0025 in dia. can be used, giving small mass and surface area. The e.m.f. obtained is the same as that from bare twisted wires, and less than that from soldered or welded junctions.

N. C.

537.363 : 541.18

1461. A simple apparatus for quantitative electrophoretic work. ALEXANDER, A. E. AND SAGGERS, L. *J. Sci. Instrum. Phys. Ind.*, **25**, 374-5 (Nov., 1948).—Apparatus for electrophoretic mobility of colloidal suspensions designed to combine simplicity of construction with improved temperature control and reduction of contamination. It utilizes the ultra-microscopic principle of illumination, but the source is placed vertically above the cell and the viewing axis is horizontal. The electrophoretic cell is entirely immersed in a water thermostat. 3 types of cell for various types of work are described.

A.

ELECTRIC DISCHARGES 537.52

537.52 : 535.33.03

The "spark" after effect. See Abstr. 1378

537.523 : 545.82 : 535.33.071

1462. Spectroscopic study of surface reactions on copper in hydrogen. REINEBECK, L. *Funk u. Ton* (No. 5) 223-6 (May, 1948) *In German*.—Since some properties of electrical discharges in gases depend on the nature of the electrode surfaces, it is possible in some cases (e.g. for Cu cathode in H_2 glow discharges) to study the latter by observing the former. Experiments with a Schüler type of discharge tube are described with particular reference to CuH.

J. D. C.

537.523.4

1463. Oscillographic observations on ultra-high-frequency sparks. PROWSE, W. A. AND JASIŃSKI, W. Letter in *Nature, Lond.*, **163**, 103-4 (Jan. 15, 1949).—Describes oscillographic studies of the collapse of the field in a resonator excited at 2800 Mc/s and filled with H_2 , N_2 or O_2 at 1 atmos. pressure. $1.4 \mu\text{sec}$ pulses are used for breakdown, which takes place well within that time. The first stage of breakdown sometimes lasts only $\sim \frac{1}{30}$ microsec. A short discussion is given.

J. D. C.

537.525

1464. Interaction of nitrogen and sulphur under silent electrical discharge: production of a reverse change. DESHMUKH, G. S. AND SIRSIKAR, S. *Proc. Indian Acad. Sci. A*, **28**, 175-84 (Oct., 1948).—The interaction of S films with N at different initial pressures between 2 and 15 cm Hg and excited in the range 3-11 kV (50 c/s). The reaction occurs only above a min. threshold potential and its velocity depends on the difference between the applied and threshold potentials in accordance with Joshi's views. Factors affecting the interaction and its reversal are discussed.

W. R. A.

537.525 : 537.56

1465. On ion movement in the plasma. FOCK, V. A.

J. Exp. Theor. Phys., USSR, **18** (No. 11) 1049–55 (1948) *In Russian*.—Approximate formulae are given for the ion velocity distribution in the plasma and for the length of persistence of an ion in a given velocity state. The calculated results may be compared with the experimental data obtained in Frisch and Kagan's investigations of the distribution of the intensity of the light emitted by an ion at a given velocity. [*J. Exp. Theor. Phys.*, **17**, 577 (1947)]. A.

537.527.5

1466. A new phenomenon in the high-pressure mercury vapour discharge. FRANCIS, V. J. AND ISAACS, G. G. Letter in *Nature, Lond.*, **163**, 168–9 (Jan. 29, 1949).—Describes a new effect found with Hg vapour discharges (~ 5 atmos., 10–20 mm long) into which, e.g. Na or Ba is evaporated. At loadings ~ 1 kW/cm an intensely luminous and surprisingly extensive region, emitting the spectrum of the volatilized material, is formed near the cathode.

J. D. C.

X-RAYS 537.531

CATHODE RAYS. POSITIVE RAYS 537.533/534

537.533.72 : 539.165.08

1467. Study of the possibilities offered by an annular, double-focussing spectrograph for the study of β -rays. HUBERT, P. *J. Rech. Cent. Nat. Rech. Sci.*, **6**, 132–8 (1948) *In French*.—A paper additional to a previous review of β -spectrographs. [See Hubert, *ibid.*, **3** (1947)]. Presents briefly the theory of the Svartholm spectrograph [Abstr. 2342 (1946), 1879 and 1880 (1947)] and examines in detail the case of an extended source. The theoretical line width for the conditions of Svartholm's experimental arrangement is found to be $< \frac{1}{3}$ of the experimental value. For optimum conditions, the Svartholm instrument is shown to have $6\times$ the intensity of a 180° spectrometer of the same resolving power. Comparison is made with the solenoidal spectrometer of Witcher [Abstr. 2182 (1941)] the intensity of which it should be possible to equal, with perhaps improved resolution, and less power consumption.

B. R.

537.533.72 : 539.165.08

1468. The design and construction of a double-focusing beta-ray spectrometer. KURIE, F. N. D., OSOBA, J. S. AND SLACK, L. *Rev. Sci. Instrum.*, **19**, 771–6 (Nov., 1948).—For the measurement of β - and γ -ray energies one requires a magnetic spectrometer of high resolution and large solid angle. One of the simplest instruments satisfying these specifications is the double-focusing β -ray spectrometer. The design and construction of such an instrument is described. This particular spectrometer has a mean radius of curvature for the electrons of 24.33 cm and preliminary measurements show that its resolution is $\sim \frac{1}{3}\%$, and that about 0.2% of all the electrons of given energy which leave the source are focused on the counter. Construction of such an instrument proved to be very easy.

A.

537.533.72 : 621.384.6

1469. Electrostatic deflection of a betatron or synchrotron beam. COURANT, E. D. AND BETHE, H. A. *Rev. Sci. Instrum.*, **19**, 632–7 (Oct., 1948).—An electrostatic deflection scheme for removing the electron beam from a betatron or synchrotron is considered. The deflection is accomplished in two stages: the first stage is an orbit expansion achieved by a sudden decrease of the magnetic field in the orbit region. The electrons move outwards in spirals of increasing pitch; if the orbit radius is 1 m and the rate of decrease of the magnetic field is $1\%/ \mu\text{sec}$, the pitch of the spiral is 1.26 cm at the "neutral position" where Hr has its maximum value. The pitch is $\propto$ (rate of decrease) $^{\frac{1}{2}}$ of the field. At the neutral position the beam enters a radial electric field which deflects it outward more sharply. If this field, and the magnetic field with it, extends a distance $\sim \frac{1}{10}$ of the orbit radius beyond the orbit, the electrons will be collimated into a beam whose angular divergence is approximately $\propto (H/E)^{\frac{1}{2}}$, where H is the magnetic field at the orbit and E the electric deflecting field. With $H = 10$ kilogauss and $E = 60$ kV/cm, the angular divergence $\simeq 10^\circ$. Curves showing the dependence of the angular divergence on E/H and on the distance to which the fields extend are presented.

A.

537.533.72 : 621.385.833

1470. Energy data and limitations of electron microscopy. V. BORRIES, B. *Optik*, **3** (No. 4) 321–77 (1948) *In German*.—A detailed survey of the factors which impose limitations on the electron microscope image. Amongst the subjects discussed are: the energy relations in the electron microscope, the resolving power of fluorescent screens, the effects of electron bombardment of the object and the properties of electron beams, particularly as regards ray apertures and intensity distributions.

H. J. H. S.

537.533.72 : 621.385.833

1471. Focusing and resolving power of the electron microscope. GLASER, W. *Öst. Ingen.-Arch.*, **3** (No. 1) 39–46 (1949) *In German*.—The limitation of the resolving power of an electron microscope, due to the fact that the axis of the objective does not coincide with the axis of the image-forming bundle, is calculated as a function of the angle between these two axes, and of the aperture of the image-forming bundle for high magnifications.

A.

537.533.74

1472. The Coulomb scattering of relativistic electrons by nuclei. MCKINLEY, W. A., JR. AND FESHBACH, H. *Phys. Rev.*, **74**, 1759–63 (Dec. 15, 1948).—The cross-section has been evaluated. The exact results obtained by Mott have been expanded in a power series in $Z/137$, where Z is the nuclear charge, the coefficients depending principally on the angle of scattering. The coefficients have been evaluated numerically. The resultant cross-sections, taken together with those evaluated previously by Bartlett and Watson for Hg, yield the cross-section for all Z to within 1% accuracy. A new approx. formula valid for $Z/137 < 0.2$ is obtained.

A.

537.533.8 : 621.385.15

1473. Secondary emission. I–II. KOLLER, L. R. *Gen. Elect. Rev.*, **51**, 33–40 (April); **50**, 50–2 (June,

1948).—An introductory review. Pt I deals with the experimental results and methods of measurement. Tables of values for δ (secondary emission coeff.) and the incident energy for δ_{max} are given for many metals, a selection of complex surfaces and a few insulators. Pt II deals with applications and with the effects produced by secondary emission in various types of tubes. A. H. W. B.

537.534 : 621.384.6

1474. Design study for a ten-bev magnetic accelerator. BROBECK, W. M. *Rev. Sci. Instrum.*, **19**, 545–51 (Sept., 1948).—A 10^{10} eV proton synchrotron design using injection from Van de Graaff generators and betatron starting to reduce the required oscillator frequency range is described. Factors affecting the design of the iron core magnet, its power supply, and associated apparatus are discussed. The synchrotron principle of magnetic particle acceleration has removed one of the limits to the energy obtainable with magnetic accelerators. Radiation loss, varying inversely as the rest energy of the particle, is negligible for protons even at 10^{10} eV. The max. obtainable energy therefore appears to be limited only by engineering feasibility and available funds. In order to gain some information on these factors a proton accelerator has been tentatively designed for what is believed to be the largest machine that could be made in the near future without departing from the techniques used on present-day machines. 10^{10} eV, which is in the range of energy of some primary cosmic-ray particles and the requirements for proton pair formation, appears to be attainable within the above restriction. A.

537.534.74

1475. A boundary value condition for proton-proton scattering. BREIT, G. AND BOURICIUS, W. G. Letter in *Phys. Rev.*, **74**, 1546–7 (Nov. 15, 1948).—The results of p - p scattering experiments in the region 0.2–14 MeV can be described in terms of approx. constancy of $R^{-1}d(Rr)/dr$ at $r \sim 0.47 e^2/mc^2$, where R is the radial wave function in a Coulomb field. This treatment is alternative to a description in terms of potential energy curves, and suggests that the shape of the wave function of the protons within a certain region is essentially independent of the relative K.E. at large separation. A. P. F.

537.534.74 : 539.152.1

Variational methods in nuclear collision problems. See Abstr. 1511

DISCHARGE TUBES . COUNTERS 537.54

537.542 : 539.16.08

1476. A study of small ether-argon Geiger-Müller counters. ROBINSON, C. V. AND PETERSON, R. E. *Rev. Sci. Instrum.*, **19**, 911–14 (Dec., 1948).—A variety of ether-argon mixtures was tried in counters with cathodes ranging in diameter from 0.268 in to 0.038 in and with wires ranging in diameter from 2.3 mils to 0.5 mil. The results suggest an optimum relationship between cathode diameter, wire size and mixture. Good characteristics were obtained with cathodes as small as 0.067 in. in diameter. Small

probing counters designed on the basis of this relationship are described. A.

537.542 : 539.16.08 : 621.385.18

1477. A microwave gas discharge counter for the detection of ionizing radiation. BROWN, S. C. AND MCCARTHY, J. J. *Rev. Sci. Instrum.*, **19**, 851–60 (Dec., 1948).—Characteristics of a γ -ray counter making use of a 3 000 Mc/s gas discharge in a coaxial mode cavity resonator are described. The breakdown of a discharge in gases at these frequencies does not depend upon secondary effects. Since the breakdown is not controlled by positive ions, shorter breakdown and resolving times than those of a Geiger-Müller counter are realized. In the h.f. discharge, ambipolar diffusion is the controlling factor in loss of electrons. A d.c. clearing field is superimposed on the a.c. field to eliminate electrons rapidly. A quenching agent is present to suppress electron emission from positive ion bombardment of the walls. The discharge is extinguished by reducing the magnetron power electronically. The plateau and sensitivity characteristics are similar to those of a G.M. counter. A.

537.542 : 539.164

1478. Air proportional counters. SIMPSON, J. A., JR. *Rev. Sci. Instrum.*, **19**, 733–43 (Nov., 1948).—Some properties of proportional counters using air at atmospheric pressure are described. It is shown that a variety of counter designs may be developed which are stable both with and without thin windows. A few counter designs which have applications in the detection of α -radioactive contamination are discussed in detail. A.

537.543 : 537.133

1479. The electron multiplier as a counter for 10-Kev protons. ROBSON, J. M. *Rev. Sci. Instrum.*, **19**, 865–71 (Dec., 1948).—Electron multipliers are being used as counters for low energy protons. Multipliers with electrodes made from soft Be-Cu count protons in the energy range 5–10 keV with an efficiency between 80 and 100%. Efficiencies of $\sim 100\%$ have been obtained with a radioactive α -source and $\sim 0.2\%$ with a RdTh γ -source. A.

537.543 : 539.16.08 : 621.385.15 : 621.383.8

1480. The photo-multiplier radiation detector. MARSHALL, F.-H., COLTMAN, J. W. AND BENNETT, A. I. *Rev. Sci. Instrum.*, **19**, 744–70 (Nov., 1948).—The detector consists of a commercial multiplier phototube arranged to register the scintillations produced in a fluorescent screen by radiation quanta. The signal pulses thus obtained are large for α -particles and other high velocity ions, much weaker for X-rays, γ -rays and high-velocity electrons. The method is limited by the presence of noise pulses caused by electrons thermally emitted at the photo-cathode; signal pulses can be discriminated from noise pulses only to the extent that their amplitudes are greater. Satisfactory detection of the weaker signal pulses has been accomplished by careful attention to (1) selection of phototubes, (2) choice of fluorescent screen, (3) efficient collection of light, and (4) proper circuit design. The new detector is especially suited to narrow-beam measurements where high counting rates are desired. However, it compares favourably with conventional detectors even when low counting rates and weak

signal pulses are involved. The detector is robust and fast, requires no special thin-window technique and shows high efficiency. The primary detecting medium, being a solid, has high absorption and is well defined in position. Full construction details are given, an analysis of performance characteristics, particularly with weak signal pulses, and numerous suggestions for further improvement. A.

IONIZATION . THERMIONICS 537.56/58

537.56 : 537.542

1481. Some properties of BF_3 in ionization chambers. BISTLINE, J. A., JR. *Rev. Sci. Instrum.*, **19**, 842-6 (Dec., 1948).—Measurements of the collection of electrons in BF_3 due to α -particle ionization pulses are described. Comparison of pulse heights showed that $1.33 \times$ as much energy is required to produce an ion pair in BF_3 as in A. The mean drift distance of an electron before capture in BF_3 at 76 cm of Hg varies from 1.25 cm at an E/P of 5 V/cm/cm to 7.25 cm at an E/P of 20. The drift velocity is observed and varies from 0.5×10^6 cm/sec to 2.5×10^6 cm/sec over the range of E/P used. The method of preparation of pure BF_3 is described. A.

537.583 : 621.385.032.216

1482. Surface ionization of barium on tungsten. MOROSOV, G. A. *J. Tech. Phys., USSR*, **17**, 1143-8 (Oct., 1947) *In Russian*.—Experimental results on the temperature dependence of the surface ionization of Ba on W depart considerably from Guthrie's data and closely approach the values obtained from Langmuir-Saha's equation. The agreement can be improved by introducing into this equation terms taking into account the excited states of the Ba atom and ion. A.

COSMIC RAYS 537.591

537.591

1483. The second shower maximum in Au, Hg and Pb. CLAY, J. AND SCHEEN, W. L. *Physica, 's Grav.*, **14**, 489-94 (Dec., 1948) *In English*.—Earlier experiments with ionization chambers had shown that the second maximum for Pb exists and is found under a layer of about 16 cm Pb. It was now measured again with counters recording showers with ≥ 2 particles, the counters being disposed so as to distinguish between particles with tracks at different angles. The showers with ≥ 3 and ≥ 4 particles were also registered. Measurements were also made with layers of Au and of Hg. For both materials the second maximum is found to exist. It can be brought about by knock-on electrons produced by mesons. A.

537.591

1484. The spectrum of the soft, electronic, part of the cosmic radiation. CLAY, J. *Physica, 's Grav.*, **14**, 499-504 (Dec., 1948) *In English*.—When one compares the absorption of cosmic radiation in 2 materials, e.g. Al and Pb, one can reduce the layer of Al so that the absorption for the mesons is the same as in Pb,

3 cm Al being equivalent to 1 cm Pb. The difference in the total absorption in such equivalent layers gives the number of electrons between 2 energy values. These values can be found by means of a formula for the range of electrons calculated by Scheen. This gives as the energy spectrum of electrons in the atmosphere $N = N_0 E^{-1.27} dE$. Calculating from the absorption spectrum in Fe and C gives $N = N_0 E^{-1.35} dE$. A.

537.591

1485. Scattering of particles in air showers. EYGES, L. *Phys. Rev.*, **74**, 1801-6 (Dec. 15, 1948).—The radial distribution of singly scattered particles in air showers is discussed. The probability $P(x')dx'$ that a singly scattered particle is found in the annular ring between x' and $x' + dx'$ is $0.16(dx'/x'^3)$, where x' is the "Moliere unit." In the deduction of this formula Belenky's expression for the mean square length of a shower, which remains valid below the critical energy, is evaluated. The main process contributing to particles at large distances from the shower axis involves the radiation, and subsequent rematerialization, of electrons below the critical energy. A.

537.591

1486. On the energy of cosmic radiation allowed by the earth's magnetic field. VALLARTA, M. S. *Phys. Rev.*, **74**, 1837-40 (Dec. 15, 1948).—Curves giving proton energies (a) below which no energy is allowed by the earth's magnetic field, (b) above which all energies are permitted, for all latitudes in case (a), for latitudes from 0° to 40° geomagnetic in case (b), are given for the following directions: (1) vertical, (2) zenith angle 45° , N, S, E and W azimuths. In addition the distance and angular corrections due to the longitude effect are given for geographic latitudes up to 40° . A.

537.591 : 539.18

1487. The production of meson pairs in various materials. CLAY, J. *Physica, 's Grav.*, **14**, 495-8 (Dec., 1948) *In English*.—The production of meson pairs in H_2O , paraffin, Al, Fe and Pb was measured at sea level as sixfold coincidences in 3 piles of counter-trays, every one covered with 10 cm of Pb. By means of a covering tray of counters the producing particle was examined. The outcome is as follows: The number of meson pairs is proportional to the number of atomic nuclei in the layers. The angle between the 2 particles is smaller than 24° and the number of producing particles is $1/16\,000$ of the meson component of the radiation. The producing particle is not ionizing and it is not unlikely that it is a photon, as the absorption is very small in H_2O and paraffin and of considerable intensity in Fe and Pb. For that reason the saturation in the latter material is already reached in a layer of 10 cm. No correlation was found between the producing particle and the extensive showers. A.

537.591.1

1488. The heavy component of primary cosmic rays. FREIER, P., LOFGREN, E. J., NEY, E. P. AND OPPENHEIMER, F. *Phys. Rev.*, **74**, 1818-27 (Dec. 15, 1948).—Evidence is presented for the existence of heavy nuclei as components of the primary cosmic radiation. Preliminary results are given for the distribution in

atomic numbers of these components. Lower limits of the energies of the particles on entrance into the atmosphere are calculated. These are, in general, above the cut-off imposed by the earth's magnetic field. The m.f.p. for nuclear collisions is of the order of 14 cm of photographic emulsion. This is longer than that expected from the geometrical cross-section and may indicate velocity dependence of nuclear forces. An example of a track that stops in emulsion is shown. This particle gives further evidence for the nuclear character of the rays, because as it slows down it captures planetary electrons and decreases its rate of energy loss. An approximate value of the H-He ratio of 4 is reported. A.

537.591.1

1489. Investigation of the primary cosmic radiation with nuclear photographic emulsions. BRADT, H. L. AND PETERS, B. *Phys. Rev.*, **74**, 1828-37 (Dec. 15, 1948).—Several methods for determining the charge and energy of heavy nuclei found to be present in the primary cosmic radiation are discussed. The application to a number of tracks of the heavy primary cosmic-ray component in Ilford C₂ emulsions shows the presence of nuclei from the neighbourhood of C in the periodic system up to the neighbourhood of Fe ($Z \approx 20 \div 30$). A nuclear explosion caused by the collision of a ≥ 3 -Bev carbon or oxygen nucleus with a silver nucleus of the emulsion is discussed. It is shown that both the magnitude of the flux and the distribution of ranges of the nuclei of the heavy primary cosmic-ray component may give valuable information regarding the origin of cosmic rays. A.

MAGNETISM 538

538.11 : 537.12 : 531.19

1490. Theory of the magnetism of the electron gas. RUMER, Y. B. *J. Exp. Theor. Phys., USSR*, **18** (No. 12) 1081-95 (1948) *In Russian*.—The investigation refers to the magnetic properties of the electron gas in the whole range of variations of temperature and magnetic field intensities. The various limiting cases are considered in greater detail. A.

538.113

1491. Resonance paramagnetic absorption in solutions of Er⁺⁺⁺ and Ce⁺⁺⁺ salts. KOSIREV, B. M. *Dokl. Akad. Nauk, SSSR*, **60** (No. 4) 567-8 (1948) *In Russian*.—By means of the reaction on the oscillator the paramagnetic absorption Q at 295°K was studied as a function of a steady magnetic field H (from 20 to 400 gauss) perpendicular to the r.f. field of frequency 2.07×10^8 c/s. Q was found independent of H for solid erbium nitrate and for strong aqueous solutions; with increasing dilution an increasingly sharp resonance appeared at 130 gauss, from which a g-factor 1.14 ± 0.05 for Er⁺⁺⁺ is obtained in good agreement with the theoretical 1.2. Similar results were found with cerium chloride and a g-value of order 0.9 was obtained for Ce⁺⁺⁺ in good agreement with the theoretical 0.84. The cause of the large observed widths of the resonance curves is discussed. D. S.

538.114

1492. Behaviour of ferromagnetics in alternating fields. POLIVANOV, K. M. *Izv. Akad. Nauk, SSSR, Fiz. Ser.*, **12** (No. 2) 98-115 (1948) *In Russian*.—A critical survey is given of the theory of the classical skin effect both for a.c. through a piece of metal and an alternating magnetic field along the metal. It is shown how from observations of such effects the true complex magnetic permeability may be deduced as a function of frequency. In practice the assumptions made of uniformity of material and linear B-H relation are not valid and the consequences of this and of magnetic viscosity of various types are discussed. 3 appendices deal quantitatively with (a) the effect of a particular type of non-uniformity of material, (b) the effect of the existence of domains with 180° walls, and (c) with 90° walls. D. S.

538.114

1493. Dependence of the energy constants of magnetic anisotropy on the density of the magnetic field. KIRENSKI, L. V. *Izv. Akad. Nauk, SSSR, Fiz. Ser.*, **12** (No. 2) 121-5 (1948) *In Russian*.—From measurements of the couple on a single crystal of meteoric origin (94% Fe, 5.5% Ni, 0.5% Co) in magnetic fields up to 3×10^4 gauss, it is deduced in agreement with results of Parasov [Abstr. 554 (1940)] that the anisotropy constant K varies with field as $K_0(1 - a/H)$. Bozorth and Williams [Abstr. 1668 (1941)] do not find this dependence. D. S.

538.114 : 538.22

1494. Verification of Néel's theory of the coercive force of finely divided ferronickels. WEIL, L. *C.R. Acad. Sci., Paris*, **227**, 1347-9 (Dec. 20, 1948) *In French*.—Measurements of the coercive force of Ni-Fe powders sufficiently finely divided for the grains to consist of single domains, have been made on 4 alloys. Measurements on samples prepared under different pressures permit extrapolation to the case of infinitely dilute powders and it is confirmed that the coercive force is proportional to the intensity of magnetization. A. E. DE B.

538.221 : 669.018 : 621.318.22

1495. The magnetic properties of ordered nickel-manganese alloys. JAFFEE, R. I. *J. Appl. Phys.*, **19**, 867-70 (Oct., 1948).—Ni-Mn alloys containing 20.1, 21.4 and 25.3% Mn in the form of Rowland rings were put into an ordered condition by very slow cooling to 380°C, and long annealing at that temperature. Magnetization curves and hysteresis loops at room temperature showed that the 21.4% Mn alloy was very soft magnetically, while the 25.3% alloy was relatively hard magnetically. The 20.1% alloy was magnetically soft, but not so soft as the 21.4% alloy. The magnetic properties of the ordered 21.4% alloy changed markedly from room temperature to about 120°C. Induction at 30 oersteds decreases very rapidly, and the permeability goes through a sharp maximum at 91°C. Coercive force and remanence also decrease within the same temperature interval. A.

538.245/.27 : 669.018

1496. Magnetic viscosity of some iron-nickel alloys and lagging discontinuities of magnetization. TELESTIN, R. V. *J. Exp. Theor. Phys., USSR*, **18** (No. 11)

970-5 (1948) *In Russian*.—The alloys under investigation had Ni contents of 43% and 78.5%, respectively. There was a very heavy dependence of the magnetic viscosity on the tensile state of the specimens. A new phenomenon was discovered in the delay of the Barkhausen discontinuities, consisting in a rotation of the vector of magnetization of the solidified regions of the spontaneous magnetization of the extended specimen. These discontinuities lag for periods up to 5 min on the variation of the magnetic field. A.

538.247 : 536.48 : 539.152.1

A new suggestion for aligning certain atomic nuclei. See Abstr. 1510

ELECTROMAGNETISM . ELECTRODYNAMICS 538.3/.5

538.3 : 591.185.63

Homing pigeon in electromagnetic fields. See Abstr. 1604

538.566 : 621.396.11

1497. The fields of refracted electromagnetic waves in the problem of a radiating point source. BREKHOV-SIKH, L. M. *Izv. Akad. Nauk, SSSR, Ser. Fiz.*, **12** (No. 3) 322-35 (1948) *In Russian*.—The source is a vertical dipole situated at any given distance above the surface of separation of two different media. The fields radiated by the dipole are expressed as a combination of plane waves, each of which follows Fresnel laws of reflection and refraction. From there the intensity of the total refracted field is deduced, and some simple formulae are obtained relating the intensity of the refracted fields to the intensity of the fields of the region containing the dipole. F. B.

538.566.2 : 621.392.22

1498. Propagation of a plane electromagnetic wave in a periodically stratified medium. LEVIN, M. L. *J. Tech. Phys., USSR*, **18** (No. 11) 1399-404 (1948) *In Russian*.—The influence of insulating bushings on the wave propagation along transmission lines is usually allowed for by the reflection coefficient of the single insulator. Yet this method is energetically insufficient because the bushings as a rule form an equidistant periodic structure all along the line which results firstly in a dispersion of the signal, secondly in impermeable bands in the frequency spectrum. These phenomena are well-known from discrete periodic systems. The paper deals with the propagation of a plane transverse electromagnetic wave (fundamental) in a medium infinite in the direction of propagation and with periodic dielectric layers. A formal equivalence should be noted with the quantum-mechanical problem of the electron moving in a periodic field, differing only in the negative sign of the dielectric constants of the layers. B. F. K.

538.566.3 : 621.396.11

1499. Observations on the gyromagnetic frequency in the gyro-interaction of radio-waves in the ionosphere. CUTOLO, M. *Nuovo Cim.*, **5**, 475-88 (Oct., 1948) *In Italian*.—New experiments were carried out in order

to verify previous observations on the gyrointeraction of radio waves in the ionosphere, chiefly for a closer study of the regular nightly variation of the resonance frequency. They have shown that the resonance frequency increases with advancing night hours; from 0.30 to 1.30 a.m. frequency corresponds to wavelengths of 282 and 276 m, from 2.00 to 3.00 it corresponds to wavelengths of about 265 m. The phenomenon seems due to the shifting of the reflection point of radio waves caused by variation of the ionic density. The gyrointeraction was perceived with greater intensity from 2.00 to 3.00 hours; it was less perceptible from 3.00 to 4.00 hours. The pulse method of artificial perturbations showed itself to be more efficient than the continuous wave excitation in producing gyro-interaction effects. A.

538.566.3 : 621.396.11 : 551.510.535

1500. On the trajectories of rays in a magnetoactive ionized medium—the ionosphere. ALPERT, Y. L. *Izv. Akad. Nauk, SSSR, Ser. Fiz.*, **12** (No. 3) 241-66 (1948) *In Russian*.—Results are given of calculations on the propagation of electromagnetic waves in a magnetoactive non-homogeneous medium. The general properties of a monochromatic wave in a homogeneous medium are examined and defined more precisely, as well as the properties of a quasi-monochromatic group of waves (signals). For the case of a medium which is non-homogeneous in the direction of the Z-axis, approximations to geometrical optics are made. The trajectory of a ray in a non-homogeneous medium such as the ionosphere is calculated, the ionosphere being characterized by the fact that the refractive index continuously decreases from unity leading to a bending of the ray in the Z-direction and to a reflection of the wave falling on the layer. The trajectory and the form of the reflected wave are examined. Some new conclusions are drawn from the results adduced. W. H.

538.566.3 : 621.396.11 : 551.510.535

1501. Experimental investigation into the so-called anisotropic ionosphere effect. ALPERT, Y. L. *Izv. Akad. Nauk, SSSR, Ser. Fiz.*, **12** (No. 3) 267-87 (1948) *In Russian*.—Observations were made throughout the year of the differing delays, as a function of the carrier frequency, of the ordinary and extraordinary rays reflected at the ionosphere, and measurements were obtained of the azimuthal differences in the direction of arrival of these two components. The measurements were made with separate mobile transmitter and receiver, set up at various ranges between 40 and 60 km, the former having a power of 0.5 kW and being modulated with 50 μ sec pulses over a carrier frequency range of 1.1 to 12 Mc/s, and the latter being equipped with an Adcock aerial and cathode-ray display unit. Reflections were examined from the E, E sporadic and F layers. Divergences in the azimuths of the arriving signals from the direction of the line joining the transmitter and receiver were found to be a completely defined function of the angle of this line and the horizontal component of the earth's magnetic field, being zero at coincidence. Good agreement was obtained between the experimental data and the results of calculation of the trajectories in a magnetoactive ionosphere. G. E. G. G.

538.566.3 : 621.396.11 : 551.510.535 : 523.72

1502. Contribution to the theory of radio wave interaction (Luxembourg-Gorki effect). GINSBURG, V. L. *Izv. Akad. Nauk, SSSR, Ser. Fiz.*, **12** (No. 3) 293-309 (1948) *In Russian*.—A theory based on the statistical study of the movement of electrons colliding with ions and molecules. The results derived have coefficients which differ from those obtained by Bailey and Martyn, who used a more elementary approach [Abstr. 4172 (1934), 1518 (1937)]. The new theory is applied to the non-linear effects occurring during the propagation of radio waves in the solar atmosphere. F. B.

MAGNETIC EFFECTS 538.6

538.632

1503. Dependence of Hall constant of ferromagnetic metals on spontaneous magnetization. KOMAR, A. AND WOLKENSTEIN, N. *Dokl. Akad. Nauk, SSSR*, **60** (No. 5) 785-6 (1948) *In Russian*.—It was found that changes of Hall constant of an Ni_3Mn alloy with degree of ordering were $\propto$ changes of the square of the saturation magnetization. For pure Ni a rather similar relation applies, change of Hall constant with temp. being $\propto$ change of the square of saturation magnetization. D. S.

538.632 : 538.652

1504. Influence of stresses on the Hall effect in iron-nickel alloys with positive striction. PRIPOROVA, G. P. *J. Exp. Theor. Phys., USSR*, **18** (No. 11) 1041-4 (1948) *In Russian*.—A qualitative investigation of the influence of plastic and elastic deformations on the Hall e.m.f. Elastic deformations do not influence the Hall coefficient R_1 . Under plastic tensile stresses R_1 decreases with progressing deformation. When a rectangular loop is obtained (single domain), the e.m.f. does not change with the field. A.

538.639

1505. Anomalous magneto-resistance of Ni_3Mn . KOMAR, A. AND PORTNYAGIN, I. *Dokl. Akad. Nauk, SSSR*, **60** (No. 4) 569-70 (1948) *In Russian*.—The change of resistance in longitudinal and transverse magnetic fields of Ni_3Mn was measured at 293°K and 77°K. For the disordered state of the alloy the changes were positive for the longitudinal, and negative for the transverse settings. For the ordered state of the alloy the changes were negative for both settings; this behaviour is anomalous from the point of view of Akulov's theory. D. S.

MOLECULAR STRUCTURE 539.13

539.13 : 535.343-15

The infra-red spectrum and structure of aluminium trimethyl. See Abstr. 1386

539.132 : 535.342.35

Ultraviolet absorption spectrum of HCl. Potential energy curve of the excited state of the HCl molecule. See Abstr. 1384

539.132 : 541.57

1506. Correlated molecular orbitals. FROST, A. A., BRAUNSTEIN, J. AND SCHWEMER, W. *J. Amer. Chem. Soc.*, **70**, 3292-5 (Oct., 1948).—The expression of the electronic wave function of a molecule as a product of one-electron molecular orbital wave functions has been modified. Factors for each pair of electrons have been included which take into account the distance r_{ij} between electrons i and j . This new form gives greater accuracy for the extreme cases of separated and united atoms and also for normal internuclear distances in molecules. W. R. A.

ATOMIC STRUCTURE . ISOTOPES 539.15

539.152.1

1507. On the virtual excited state of the Be^9 nucleus. LONGMIRE, C. *Phys. Rev.*, **74**, 1773-5 (Dec. 15, 1948).—An attempt has been made, on the basis of a simple model, to understand the energy and width of the virtual level of the Be^9 nucleus, which was found by Davis and Hafner by inelastic scattering of protons from Be^9 . The model used for the Be^9 nucleus was that of a neutron moving in a potential well provided by the remainder of the nucleus. There is no striking agreement numerically between the model and experiment, but a loose interpretation by means of the model is possible. A.

539.152.1

1508. Deuteron and triton methods. RARITA, W. *Phys. Rev.*, **74**, 1799-801 (Dec. 15, 1948).—Some methods are reported of calculating accurately the depths of different shape potentials of the deuteron for non-central forces. Starting with a square well, the radial S and D wave functions u and w are known outside the well. Inside the range of interaction a general expansion in terms of modes is assumed. These modes for u and w are taken to be Bessel functions of order $\frac{1}{2}$ and $\frac{3}{2}$, respectively. The wavelengths of these modes are determined by requiring the continuity of the logarithmic derivative. Using the variational principle for one mode and then two such modes gives 95% and 99% of the full binding energy. With an exponential $\times$ a power of the interparticle distance as modes, the joining condition was relaxed so as to require only continuity at the potential edge. The results for the square well were excellent. This method was extended to the exponential and meson potentials. The accurate depths for these potentials were calculated with these modes as initial trial wave function for the iteration-variational method developed by Feshbach and Schwinger. The relaxed continuity procedure was successfully applied to the triton problem without and with tensor forces. A.

539.152.1 : 535.343.4-14

1509. Erratum. Nuclear spins and quadrupole moments of B^{10} and B^{11} . GORDY, W. AND RING, H. *Phys. Rev.*, **75**, 208 (Jan. 1, 1949).—See Abstr. 660 (1949).

539.152.1 : 536.48 : 538.247

1510. A new suggestion for aligning certain atomic nuclei. GORTER, C. J. Letter in *Physica*, 's Grav., **14**,

504 (Dec., 1948) *In English*.—Electrons in the partially filled 3d or 4f shells of paramagnetic ions produce fields of almost 10^6 oersted at the nucleus. Accordingly the bulk of nuclei possessing a nuclear magnetic moment of $\sim$ one nuclear magneton would be aligned at about 0.01°K in an external field of a few hundred oersted which is merely required to align the electronic orbitals. This temperature can be produced by demagnetization from, say, 25 000 to a few 100 oersted of an intimate mixture of different paramagnetic ions of an element (e.g. Cr) which has no nuclear moment. Thus alignment of nuclei without the difficult two-stage cooling so far envisaged becomes possible.

H. L.

539.152.1 : 537.534.74

1511. Variational methods in nuclear collision problems. KOHN, W. *Phys. Rev.*, **74**, 1763–72 (Dec. 15, 1948).—Variational methods, similar to the Rayleigh–Ritz method for bound state calculations, are developed for the phase shifts and elements of the scattering matrix in nuclear collisions. Numerical applications to neutron-proton and neutron-deuteron scattering involving trial functions with undetermined coefficients are described. Another variational principle, for scattering amplitudes, is shown to lead to the Born approximations and a formula recently derived by Schwinger. It may also be used in conjunction with the method of undetermined coefficients.

A.

539.152.1 : 539.16 : 539.17

1512. 1947 summary of nuclear data (August 1946–November 1947). *Nucleonics*, **2** (No. 5, Pt 2) 82–186 (May, 1948).—References to all data received during the period are arranged in order of elements, and the quantitative and qualitative information in each reference reproduced in abbreviated form.

A. P. F.

539.155.2

1513. The relative abundance of the zinc isotopes. HESS, D. C., JR., INGRAM, M. G. AND HAYDEN, R. J. Letter in *Phys. Rev.*, **74**, 1531–2 (Nov. 15, 1948).—The present authors and Leland and Nier [Abstr. 3420 (1948)] reported relative abundances for Zn appreciably different from Nier's original results [Abstr. 13 (1937)]. The measurements have been repeated using chemically and electrolytically prepared Zn to investigate the effect on relative abundance of the method of preparation. No difference is observed, and the later results are supported.

T. G. P.

539.155.2 : 523.161

Lower limit to the ratio C^{12}/C^{13} in interstellar matter. See Abstr. 1277

539.155.2 : 538.691

1514. Mass deposition of completely resolved samarium isotopes. SHAW, A. E. Letter in *Phys. Rev.*, **74**, 980–1 (Oct. 15, 1948).—A positive ion source in which material is heated and ionized in a W crucible by a W loop filament was used to produce 5 micrograms of completely resolved Sm isotopes in a double-focusing mass spectrograph [Abstr. 2579 (1947)]. Ions from fused Sm_2O_3 , formed by bombardment with 0.175 amp. of 700-volt electrons, were accelerated by 8 500 volts giving an average intensity at Sm^{154} of 3×10^{-6} amps., for 215 minutes. Deposits were collected in rectangular pure Al cups (microblasted

surface) and were found to include the oxides of Sm.

T. G. P.

539.155.2 : 550.93

Lead isotopes and the age of the earth. See Abstr. 1573

RADIOACTIVITY. α -, β - AND γ -RAYS 539.16

539.16.08

1515. A simple spectrometer-counter for radioactive isotope measurements. WOODWARD, L. L. AND McCOWN, D. A. Note in *Rev. Sci. Instrum.*, **19**, 823–4 (Nov., 1948).—A radioactive sample and an end-window G.M. counter are mounted between the poles of a magnet; the counter intercepts β -rays after 180° deflection in the field, and is shielded against direct radiation. The difference between the counting rates with and without magnetic field gives a measure of β^- activity; reversal of the field gives a measure of β^+ activity. Separate β^+ and β^- decay curves can be plotted, and have enabled radioactive isotopes to be identified where composite decay curves could not be resolved. Approximate end-point energies can be measured by plotting counting rate against magnet current. Curves for the β^- and β^+ activities from $Se + d$ are given to illustrate the method.

T. G. P.

539.16.08

1516. Automatic adjustment of cloud chambers. RICHARD-FOY, R. *J. Phys. Radium (Sér. 8)*, **9**, 311–12 (Dec., 1948) *In French*.—A mechanism is described for regulating the backing pressure of a cloud chamber in which the forward piston position is pressure-defined, and a modification of this mechanism is considered in which compensation against variations of ambient temperature is achieved.

J. G. W.

539.16.08

1517. Note on high pressure cloud-chamber operation. LAUGHLIN, J. S. Note in *Rev. Sci. Instrum.*, **19**, 918–19 (Dec., 1948).—A discussion of the operating conditions of a high pressure cloud chamber, with particular reference to the reduction of expansion ratio with increasing total pressure.

J. G. W.

539.16.08 : 519.21

Statistical error in absorption experiments. See Abstr. 1268

539.16.08 : 537.542

A study of small ether-argon Geiger–Müller counters. See Abstr. 1476

539.16.08 : 545.8

1518. Measurement of radiocarbon as CO_2 in Geiger–Müller counters. EIDINOFF, M. L. *Science*, **108**, 535–6 (Nov. 12, 1948).—With CO_2 pressures of 10–50 cm Hg and an admixture of 2 cm of CS_2 nearly 100% counting efficiency is attained in a counter with fine wire anode. Linearity of counting rate with pressure of active CO_2 is demonstrated up to 4 000 counts/min.

R. T. F.

539.16.08 : 621.318.572

1519. A simple arrangement of high resolving power for the detection of coincidences or anticoincidences. PÓCZA, E. F. AND FARAGÓ, P. S. Letter in *J. Sci.*

Instrum. Phys. Ind., **25**, 399 (Nov., 1948).—The quenching pulses from a coincidence in two multi-vibrator-quenched G.-M. tubes, directly connected to the X and Y plates, respectively, of a c.r.t., cause a line deflection at $\sim 45^\circ$, viewed by a photo-multiplier tube through an opaque screen slotted at the same angle; the output pulses are recorded. A resolving time of 10^{-7} sec has been obtained. Anti-coincidences can be counted by modifying the opaque screen.

A. O. S.

539.16.08 : 621.318.572 : 519.2

Resolution of devices actuated by random events. See Abstr. 1267

539.16.08 : 621.385.15 : 621.383.8 : 537.543

Photo-multiplier radiation detector. See Abstr. 1480

539.163.2

1520. The alpha-ray spectrum of polonium. WADEY, W. G. *Phys. Rev.*, **74**, 1846-53 (Dec. 15, 1948).—Measurements of the α -ray spectra of Po mounted on Ni, Ag and Cd by means of a 180-degree-focusing magnetic spectrograph are reported and discussed. The weak line series reported by Chang was not apparent. The hypothesis is proposed that the α -ray spectra seen to date have not been caused by the element Po, but by the diffusion of the Po into the mounting metal.

A.

539.164 : 537.542

Air proportional counters. See Abstr. 1478

539.164.94 : 537.133 : 578.088.5

1521. On the effective cross-section of protons and α -rays in relation to the radiation-sensitive volume of radiobiological elementary reactions. SOMMERMEYER, K. *Z. Naturforsch.*, **3b**, 57-9 (Jan.-Feb., 1948) *In German*.—The experiments on production of lethal mutations in *Drosophila* by neutrons [Abstr. 3414 (1938)] require an anomalous low value for the biological effective cross-section of the recoil proton ionization column radius $< 2 \times 10^{-7}$ cm. Evidence from Wilson photographs or Jaffé theory suggests a value 10^{-6} cm. Lea has shown for *B. coli*, virus and phages that the discrepancy is quite general. The velocity distribution in the ionization column includes many slow electrons, of which $\sim 50\%$ have an energy < 2.5 eV. It is pointed out that much of the evidence on ionization is based on light molecules (2 or 3 atoms) and the gaseous state. The radiation-sensitive volume in organic substances of very large molecular weight, such as genes in chromosome fibres, may be due to the different excitation probability of these macro-molecules.

T. A. C.

539.165 : 539.152.1

1522. Regularities in the disintegration energies of β -emitters. SITTE, K. *Acta Phys. Austriaca*, **2** (No. 1) 1-12 (1948) *In German*.—Feather's rule [*Proc. Roy. Soc. Edinb.*, **62**, 211 (1946)] on the energies of successive β -decays is discussed as a consequence of the binding energy curve for isobaric nuclei of even mass number. For isobars of odd mass number, no alternation of energies (and $\therefore \frac{1}{2}$ -lives) is to be expected. These conclusions are supported by evidence from fission-product disintegration chains [Abstr. 1303 (1947)]. Similar considerations are applied to the β -decay energies for nuclei of neighbouring Z and the same neutron excess ($N - P$).

A. P. F.

539.165.2 : 539.11

1523. On the theory of the recoil in β -decay. KOFOED-HANSEN, O. *Phys. Rev.*, **74**, 1785-8 (Dec. 15, 1948).—On the basis of the Fermi theory of β -decay a formula for the recoil spectrum is derived, and the average values of the momentum and energy of the recoil are calculated. Some properties of the recoil spectrum are discussed in the case when the β -decay is followed by γ -ray emission. It is shown that the average recoil energy is independent of a possible angular correlation between successive β - and γ -rays. Finally the influence of a finite mass of the neutrino and the neglect of the kinetic energy of the recoil in the energy balance is discussed.

539.165.2 : 539.11

The search for the neutrino through nuclear recoil experiments. See Abstr. 1533

539.166.7

1524. The absorption of gamma-radiation. COWAN, C. L. *Phys. Rev.*, **74**, 1841-5 (Dec. 15, 1948).—Absorption coefficients for γ -radiation ranging from 0.32 to 2.8 MeV penetrating various elements ranging from low to high Z were measured. A geometry was employed which yielded results whose accuracy was limited only by statistics and background corrections. The source, absorbers of area just sufficient to completely intercept all detected γ -rays, and a Geiger tube were suspended outdoors about 25 ft above the ground. The results are in excellent agreement with theoretical predictions.

A.

NUCLEAR REACTIONS 539.17

539.17 : 521.042

1525. On the genesis of the chemical elements. MEYER, S. AND KOSS-ROSENQVIST, A. *Acta Phys. Austriaca*, **2** (No. 2) 109-23 (1948); *S.B. Öst. Akad. Wiss. IIa*, **156**, 625-40 (1948) *In German*.—The table of isotopes is divided up into those of odd and those of even Z . The former can be regarded as built up from H simply by cumulative additions of He^4 and He^6 ; the latter exhibit irregularities which can be accounted for if one also postulates chains of successive α - and β -decays (of the kind observed in the naturally radioactive series) following the synthetic process.

A. P. F.

539.17 : 521.042 : 539.164

1526. Can one regard elements with atomic weight divisible by 4 as being built up of alpha-particles? MEYER, S. AND KOSS-ROSENQVIST, A. *Acta Phys. Austriaca*, **2** (No. 2) 124-32 (1948); *S.B. Öst. Akad. Wiss. IIa*, **156**, 641-9 (1948) *In German*.—It is concluded that one cannot account for the formation of the known isotopes by an α -particle synthesis. Certain regularities appear if one divides the isotopes into 2 groups, regarding them as possible descendants of the U and Th radioactive series respectively.

A. P. F.

539.17 : 523.12 : 521.042

The relative abundance of the elements. See Abstr. 1271

539.172.3

1527. Cross section for the reaction $\text{C}^{12}(\gamma, n)\text{C}^{11}$. LAWSON, J. L. AND PERLMAN, M. L. Letter in *Phys.*

Rev., **74**, 1190-1 (Nov. 1, 1948).—Pure graphite was irradiated with X-rays from a betatron operated at energies of 50 and 98 MeV. The quantum intensity was determined with an ionization chamber, calibrated at low intensity by means of a pair spectrometer. The absolute yield of C^{11} was found by measuring its radioactive decay. The cross-section integrated over the single sharp peak at ~ 30 MeV [Abstr. 2566 (1948)] was found to be $\sim 1.5 \cdot 10^{-25}$ MeV cm^2 (estimated error $\pm 20\%$).

A. P. F.

539.172.3 : 539.166

1528. On the relative yields of (γ, n) reactions. BOWERS, W. A. Letter in *Phys. Rev.*, **74**, 1538-9 (Nov. 15, 1948).—It is suggested that the sharp increase in (γ, n) cross-sections at $A \simeq 60$ [Abstr. 3936 (1948)] does not necessarily conflict with the statistical theory of nuclei, as the results of the theory are sensitive to the value assumed for the neutron binding energy in a given nucleus.

A. P. F.

539.172.4

1529. The formation of the 90 day and 9.3 hour isomers of Te^{127} from 93 hour Sb^{127} in the fission of uranium. BEYDON, J. *C.R. Acad. Sci., Paris*, **227**, 1159-61 (Nov. 29, 1948) *In French*.—After prolonged slow neutron irradiation of U, Sb was extracted and samples of Te were separated from it at various later times. The decay curves of the Te were analysed into the component periods (9.3 h and 90 d) so as to find the relative proportions of the isomers at the moment of separation from the Sb. The results showed that both are formed directly from Sb, about 16% of the disintegrations yielding the 90 d isomer.

A. P. F.

539.172.4 : 539.164

1530. High energy spallation and fission products of uranium. O'CONNOR, P. R. AND SEABORG, G. T. Letter in *Phys. Rev.*, **74**, 1189-90 (Nov. 1, 1948).—Natural U was bombarded with 380 MeV He ions, and chemical separations were made of the reaction products. The α - and β -radiations from the products were measured, and the relative yields of the various isotopes deduced. The yield curve exhibits a single maximum at A slightly < 120 , essentially similar to the curve for fission of Bi by high energy deuterons [Abstr. 3447 (1948)]. The yield falls to a minimum at $A \sim 190$ and then rises. Products with $A > 180$ are thought due to spalling, and all other products to a preferentially symmetrical fission after evaporation of several neutrons.

A. P. F.

ATOM AND MOLECULE BEAMS . MESONS NEUTRONS 539.18

539.18 : 535.14

1531. Search for photons from meson-capture. PICCIONI, O. *Phys. Rev.*, **74**, 1754-8 (Dec. 15, 1948).—High energy photons ($\simeq 50$ MeV) associated with mesons stopped in Fe have been searched for. The experimental evidence shows that no such photons arise from the capture of negative mesons or from the free decay of positive ones.

A.

539.18 : 537.123

1532. On the mean life of π -mesons and the capture of μ -mesons by nuclei. D'ESPAGNAT, B. *C.R. Acad.*

Sci., Paris, **227**, 1343-5 (Dec. 20, 1948) *In French*.—Assuming the meson decay $\pi \rightarrow \mu + \nu$ where ν is a light particle of spin $\frac{1}{2}$, the mean lives of the π -meson against decay and the μ -mesons against capture by nuclei are calculated. For nuclear charge $Z = 11$ the ratio $\simeq 10^{-2}$ and it increases with Z . G. J. K.

539.18 : 537.591

The production of meson pairs in various materials. See Abstr. 1487

539.18 : 539.165.2

1533. The search for the neutrino through nuclear recoil experiments. ALLEN, J. S. *Amer. J. Phys.*, **16**, 451-61 (Dec., 1948).—A review article, which includes some new data obtained by the author on the angular correlation of the nuclear recoil and the β -particle in the decay of He^6 . This data is best fitted by the correlation predicted by the Gamow-Teller axial vector interaction. It concludes that recoils from K-capture, and neutrino-electron correlation functions, are the most fruitful fields to be studied. B. R.

539.185

1534. On a spherical neutron diffusion problem. HANSSON, L. AND WALLER, I. *Ark. Mat. Astr. Fys.*, **36 B** (No. 8) 7 pp. (1948) *In English*.—An iteration method used by Fermi for plane problems is extended to the case of a perfectly absorbing sphere surrounded by an infinite non-capturing medium. The distributions of the neutrons in direction and space are obtained, and the results compared with those found by the variational method [Abstr. 2254 (1947)]. See also Abstr. 2246 (1947), 1916 (1948).

A. P. F.

539.185

1535. High energy neutron detector. WIEGAND, C. *Rev. Sci. Instrum.*, **19**, 790-2 (Nov., 1948).—A neutron detector which utilizes the fission of Bi and responds only to neutrons of energy $> \sim 50$ MeV is described. The efficiency is low (about 10^{-6}), but the instrument is suitable for monitoring a high energy neutron beam and for beam attenuation measurements. A.

539.185 : 537.122

1536. On the interaction of neutrons with electrons. HOLMBERG, B. *Ark. Mat. Astr. Fys.*, **36 A**, Paper 6, 15 pp. (1948) *In English*.—The static interaction between neutron and electron is set out for all possible processes, using pseudoscalar charged meson theory. Of 10 processes, only the 2 involving Coulomb interaction between the electron and a proton or meson are important. The interaction integral is found to be $\sim 10^{-45}$ erg cm^3 . Better agreement with expt. [Abstr. 1075 (1948)] is obtained using a non-symmetrical scalar-pseudoscalar theory [Abstr. 1147 (1944)].

A. P. F.

539.185.7

1537. Filtration and resonance absorption of thermal neutrons. STUPP, W. *Ann. Phys., Lpz. (Folge 5)* **43** (No. 8) 630-6 (1943) *In German*.—Cross-section determinations, superseded by subsequent publications [e.g. Abstr. 1915 (1948)].

539.185.7

1538. On an integral equation governing the diffusion of neutrons. DRĂGANU, M. *C.R. Acad. Sci., Paris*, **226**, 1698-9 (May 24, 1948) *In French*.—The integro-differential equation of neutron diffusion, in spite of

its singularities, can be formally solved by the method of iterated kernels, when there is spherical symmetry and isotropy. The anisotropical problem is also amenable to the same method. — G. J. K.

STRUCTURE OF SOLIDS 539.2

ELASTICITY . STRENGTH . RHEOLOGY
539.3/8

1539. On the theory of elastic after-working. KUHLMANN, D. *Z. Phys.*, **124** (Nos 7-12) 468-81 (1948) *In German*.—Derives an expression $x = A \log t - B$ for the development with time t of the elastic after-effect x , on the assumption that elementary processes are involved which have activation energies proportional to the instantaneous value of the strain. Amorphous substances are discussed in detail, the after-effects being attributed to the plastic deformation of small domains by the "notch" effect. Experimental values for glass and metals are considered. The electrical after-effects in dielectrics are also discussed. G. O. J.

539.31.

1540. Planar elasticity as a potential theory. ISAACS, R. *Rev. Univ. Nac. Tucuman*, **6**, 263-72 (May, 1948) *In English*.—The planar theory is cast into a form where the potential functions are polygenic functions of a complex variable, the derivative of the potential at any point and in any direction being (tensile stress) $+ i$ (shearing stress) at that point and in that direction. The relevant properties of polygenic functions are derived and the theory of elasticity is then developed. L. S. G.

539.32 : 535.81

1541. The determination of the elastic constants of optical glasses by Hiedemann's method. ALLEGRETTI, L. *Ric. Sci.*, **18**, 995-8 (Aug.-Sept., 1948) *In Italian*.—Describes measurements of moduli of elasticity and rigidity and Poisson's ratio for 11 Italian optical glasses (composition not stated) by Hiedemann's method [Abstr. 4331 (1935)]. This employs super-sonic stationary waves and an optical method for determining the wavelength, and avoids complications due to elastic after-effects which affect static measurements. Details of the electrical and optical systems are given. G. O. J.

539.37 : 532.13

The viscosity of amorphous bodies. See Abstr. 1333

539.374 : 534.211

Propagation of elastic and viscously-plastic waves in rods. See Abstr. 1363

PHYSICAL CHEMISTRY 541

REACTION KINETICS 541.124/128

541.124 : 534.321.9

1542. Mechanism of certain chemical reactions produced by ultrasonic waves on substances in aqueous solution. GRABAR, P. AND PRUDHOMME, R. *C.R. Acad. Sci., Paris*, **226**, 1821-3 (May 31, 1948) *In French*.—Previous hypotheses on the mechanism of promotion of chemical reactivity by ultrasonic waves are briefly discussed. The view that the reactions require the presence of O or air is dispelled by the authors' acquisition of the same results in the presence of inert gases such as N and A, and in de-oxygenized solutions. Experimental evidence is now submitted to prove that the oxidizing action of the ultrasonic waves must be attributed to the water itself. H. H. HO.

541.124/127

1543. A new type of topochemical reaction. NEUMAN, M. B. AND SHUSHUNOV, V. A. *Dokl. Akad. Nauk, SSSR*, **60** (No. 8) 1347-50 (1948) *In Russian*.—6 examples of topochemical reactions are given in which the period of induction, after falling to a minimum with increasing temperature, starts to increase on increasing the temperature further. A theory is developed to explain these reactions. W. H.

ELECTROCHEMISTRY 541.13

541.13

1544. Some electrochemical properties of shales.

WYLLIE, M. R. J. *Science*, **108**, 684-6 (Dec. 17, 1948).—The application of glass membranes to comparisons of H ion activities in aqueous solutions suggests analogous applications to the use of natural shale membranes in NaCl solutions to determine Na ion activities, the solution being in contact with a cleavage surface of the shale. Both of the (U.S.) shales examined are shown to have marked Na electrode properties at concentrations of up to 1.0 M, but at higher concentrations differences in behaviour result between the 2 shales. There are no electrochemical differences between the red and grey portions of a shale, indicating that the state of reduction of the Fe present is not an important influencing factor. J. G.

541.135 : 541.64

1545. Polyelectrolytes. FUOSS, R. M. *Science*, **108**, 545-50 (Nov. 19, 1948).—Polymers which are electrolytes when in solution have been termed "polyelectrolytes." All the examples given contain quaternary N atoms which may form part of the long chain of the polymer or be present in the side chains. On copolymerizing a mixture of vinyl pyridine and styrene and then treating with alkyl halide a polyelectrolyte is formed, the ratio of ion atoms arising from the heterocyclic rings to the chain atoms being controllable. Unlike simple electrolytes a polyelectrolyte would be expected to exhibit ion association to a marked degree, and this is borne out by measurements of conductance and osmotic pressure in various solvents. The high viscosity of solutions of polyelectrolytes and its concentration dependence are

considered due to the high charge density at the polyions, and the effect of added simple electrolytes is in agreement with this.

J. O'M. B.

541.135.5

1546. Variation of standard electrode potentials with temperature. EVERDELL, M. H. Letter in *Nature, Lond.*, **162**, 995-6 (Dec. 25, 1948).—From an analysis of the processes which take place in a cell with electrolyte at differing temps. at anode and cathode, it is argued that the potential of the standard H electrode (as that of any other electrode) varies with temp. The analysis, however, neglects all thermo-electric effects in the metal leads in the outside circuit, and the contribution to the e.m.f. of the liquid junction potential.

H. H. HO.

541.135.5 : 545.37

Simple drop-counter for use in polarographic analysis. See Abstr. 1553

541.136 : 621.352.1

1547. A low temperature liquid sulfur dioxide cell. SCHASCHL, E. AND McDONALD, H. J. *J. Electrochem. Soc.*, **94**, 299-308 (Dec., 1948).—The possibility was investigated of constructing a low temp. cell in a liquid SO₂ medium. Vapour pressures and solubilities of several highly soluble salts in liquid SO₂ were determined in an effort to obtain an electrolyte which would remain liquid at atmo. pressure and up to room temp. Mg and Na were chosen as anodes because of high potential and low cost. The cell Na; IBr₃, FeCl₃, SO₂; Fe was the most promising one developed. Discharge characteristics and shelf life were investigated. The open circuit voltage varied from 3.5 V at room temp. to 2.7 V at -60°C. Under high drain, the voltage varied from 2.6 to 1.2 over the same temp. range, and the short-circuited current from 70 to 16 MA/cm².

A.

PHOTOCHEMISTRY 541.14

541.14

1548. Photosensitized reactions. STEACIE, E. W. R. *Canad. J. Res.*, **B**, **26**, 609-18 (Sept., 1948).—A review is given of gas reactions photosensitized by metal vapours, with special emphasis on the reactions of hydrocarbons sensitized by Zn, Cd and Hg. Extensive bibliography.

A.

541.14

1549. Halogen sensitized photoreactions. SPINKS, J. W. T. *Canad. J. Res.*, **B**, **26**, 629-42 (Sept., 1948).—Spectroscopic evidence indicates that reactions photosensitized by F would take place by way of F atoms. Similarly, the sensitizing action of Cl will practically always be due to Cl atoms. For Br, when the wavelength is < 5 107 Å, reaction will be by way of Br atoms. Experiments using wavelengths 5 107-6 290 Å also probably involve Br atoms although the possibility of reaction due to excited Br molecules cannot be wholly ruled out. I atoms are produced in photosensitization experiments involving I and wavelengths < 4 989 Å. Experimental evidence also favours the production of I atoms using wavelengths up to 6 200 Å. Mechanisms in accordance with the above are advanced for a number of Cl sensitized oxidation reactions. In the oxidation reactions an

intermediate compound with a trivalent C is formed which reacts with O forming a peroxide, giving rise to a chain reaction. Reactions sensitized by Br and I are also discussed. It appears that all the halogen sensitized gaseous photoreactions thus far known can be explained by chemical mechanisms involving halogen atoms.

A.

541.14 : 537.531

1550. Relationship between structure of nitrogenous compounds and their sensitivity to X-rays. DALE, W. M. AND DAVIES, J. V. Letter in *Nature, Lond.*, **163**, 64-5 (Jan. 8, 1949).—The ionic yield of the deamination of glycine rises to a value of 3 as the glycine concentration increases to 0.2 g/ml. The interpretation of this result in terms of OH-radicals, and the influence of the position of the NH₂-radical in a molecule on its radio-sensitivity, are discussed.

C. B. A.

ATOMIC THEORY 541.2

541.25 : 541.113 : 536.75

1551. Volume, internal energy, and entropy of amorphous and crystalline selenium. BORELIUS, G. AND PAULSON, K. A. *Ark. Mat. Astr. Fys.*, **33 A**, Paper 7, 16 pp. (1946) In English.—The linear expansion coefficients, α , for bars of polycrystalline, amorphous and spherulitic Se crystallized at 75°C, have been measured over the ranges -78 to 219, -78 to 34 and 55 to 95°C, respectively. These have been compared with the density and X-ray measurements of other workers. The atomic volume, V , of Se in the various states has been calculated. The atomic heat, C , of polycr. Se has been measured over the range 180°C to the melting point (221°C) by the method of Moser [Abstr. 272 (1937)] and Sykes and Jones [Abstr. 4776 (1936)]. C increases abnormally within 3 deg. of the melting point. From C and the latent heat of fusion (taken as 1 280 cal/g. atom) the internal energies, V , and entropies, S , of polycrystalline and amorphous Se are calculated at 50 deg. intervals over the range 50 to 600°K by graphical integration. It is concluded that the differences ΔV , ΔU and ΔS between the values of V , U and S for amorphous and polycrystalline Se in the range of the supercooled liquid from 300 to 394°K are dependent only on the arrangement of the atoms in the liquid, and thus ΔV , ΔU and ΔS should be good tests of theories of the structure of the liquid state.

S. W.

CHEMICAL STRUCTURE 541.4/.6

541.57

1552. Hydrogen bond and processes of proton transfer. SOKOLOV, N. D. *Dokl. Akad. Nauk, SSSR*, **60** (No. 5) 825-8 (1948) In Russian.—It was shown in a previous paper [Dokl. Akad. Nauk, SSSR, **58**, 611 (1947)] that the H-bond between a polar molecule AH and the atom B of a neighbouring molecule is determined by non-electrostatic (exchange) forces of interaction of the H atom with an unseparated electron pair of the B atom (donor-acceptor bond).

The relation between the energy ϵ of this bond and the inter-atomic distance may be satisfactorily approximated by a function similar in structure to Morse's function, with the difference that the term of Morse's function expressing the energy of repulsion between H and B must be completed by a factor ϵ^{-brAH} (where $b = 2$ atomic units). This takes account of the decrease of the repulsion owing to the polarity of the A-H bond. The calculations are carried through for reactions of the type $AH + B \rightleftharpoons A^- + (HB)^+$ and the results compared with experimental data taken from various authors. A relation for the reaction constant eventually arrived at is found to coincide formally with one due to Brönstedt and Duus [*Z. Phys. Chem.*, **A 117**, 299 (1925)], although there are slight deviations between the numerical results obtained in applications of either formula.

B. F. K.

541.64 : 541.135

Polyelectrolytes. See Abstr. 1545

CHEMICAL ANALYSIS 543/545

545.37 : 541.135.5

1553. Simple drop-counter for use in polarographic analysis. GOLDSMITH, K. *J. Sci. Instrum. Phys. Ind.*, **25**, 385 (Nov., 1948).—A self-contained electronic device is described for counting the drop rate of Hg

in a polarographic cell. The rapid decrease in electrolytic current as each drop falls induces a potential across an inductance in series with the cell. This potential is amplified and trips a thyatron valve which sends a pulse through an electromagnetic counter. The electronic relay is returned to its non-conducting state by use of a hot wire relay. Virtually no current is taken from the cell by the device.

J. O'M. B.

545.82

1554. On a spectroscopic method of detecting very small amounts of water. SAUTER, E. *Z. Naturforsch.*, **3a**, 392-5 (July, 1948) In German.—A spectroscopic method of detecting contaminations with water as small as 1/180 000 by means of the decay spectrum of the OH group produced during the excitation of water in a discharge tube.

F. L.

545.824 : 548.733

1555. An X-ray diffraction photometer. CHRIST, C. L., CHAMPAYGNE, E. F., BARNES, R. B. AND SALZMAN, C. F., JR. *Rev. Sci. Instrum.*, **19**, 872-8 (Dec., 1948).—An automatic recording instrument which permits the direct comparison of the X-ray diffraction patterns of two separate powder samples has been constructed through suitable modification of a commercial Geiger counter X-ray diffraction spectrometer. Some of the experimental results obtained with the new instrument are shown, and possible applications to qualitative and quantitative analysis indicated.

A.

CRYSTALLOGRAPHY 548

548.0 : 537 : 537.226

Dielectric losses in optically-excited crystals. See Abstr. 1443

548.24 : 539.219.2

1556. Macroscopic description of the phenomenon of crystal twinning. LIFSHITS, I. M. *J. Exp. Theor. Phys., USSR*, **18** (No. 12) 1134-43 (1948) In Russian.—The attempt at a macroscopic description of the twinning phenomenon is built on the conception of the non-linear relation between the stress tensor p_{ik} and the deformation tensor u_{ik} . The consequences of the condition of mechanical and thermodynamical stability are considered. The results obtained supply satisfactory explanations for most of the effects observed by Garber (8 ref. to Garber's papers). A.

548.55

1557. New procedure for obtaining large single crystals. BOUHET, C. AND LAFONT, R. *C.R. Acad. Sci., Paris*, **226**, 1823-5 (May 31, 1948) In French.—The crystal is grown from a seed suspended in a saturated solution maintained at constant temp. The rate of growth is controlled by varying the supply of supersaturated solution to the crystallizing vessel. Crystals of sodium chloride, and magnesium and zinc sulphate were grown.

J. A. F.

548.57

1558. Preparation and properties of crystals of barium titanate, $BaTiO_3$. KAY, H. F. *Acta Cryst.*, **1**, 229-37 (Nov., 1948) In English.—A technique is

described for the preparation of "single" crystals of $BaTiO_3$. At room temp. the crystals are complexes of habit appropriate to cubic symmetry, but consisting of multiply-twinned tetragonal components with orientation very sensitive to externally applied pressure or electric fields. Optical and X-ray observations have been used in a detailed study of the nature of the transitions occurring near 120°C, near 0°C, and near -90°C.

A.

MOLECULAR AND X-RAY CRYSTALLOGRAPHY 548.7

548.7

1559. Dynamics of a crystal lattice occupying the half-space. LIFSHITS, I. M. AND ROSENZWEIG, L. N. *J. Exp. Theor. Phys., USSR*, **18** (No. 11) 1012-22 (1948) In Russian.—The methods of the theory of regular excitations are used for investigating the influence of the free crystal surface on its eigen-frequency spectrum. Formulae expressing the dispersion law and the form of the surface waves in the lattice are obtained. Apart from those surface waves which in the limiting case of the continuum degenerate into ordinary Rayleigh waves, there are surface waves, in the case of complex crystal lattices, not offering any analogy to the theory of elasticity.

A.

548.7 : 535.375.5
Raman spectrum of a single crystal of $\text{NH}_4 \cdot \text{H}_2 \cdot \text{PO}_4$.
See Abstr. 1403

548.73
1560. The crystal structure of *p*-nitroaniline, $\text{NO}_2 \cdot \text{C}_6\text{H}_4 \cdot \text{NH}_2$. ABRAHAMS, S. C. AND ROBERTSON, J. M. *Acta Cryst.*, **1**, 252-9 (Nov., 1948) In English.

548.73
1561. Crystal chemical studies of the 5*f*-series of elements. I. New structure types. ZACHARIASEN, W. H. *Acta Cryst.*, **1**, 265-8 (Nov., 1948) In English.—Gives brief descriptions of new structure types observed for simple compounds of the 5*f*-series of elements and of related elements. A.

548.73
1562. Crystal chemical studies of the 5*f*-series of elements. II. The crystal structure of Cs_2PuCl_6 . ZACHARIASEN, W. H. *Acta Cryst.*, **1**, 268-9 (Nov., 1948) In English.

548.73 : 669.225.72
1563. An X-ray diffraction study of the silver-magnesium alloy system. LETNER, H. R. *Univ. Pittsburg Bull.*, **43**, 151-61 (Feb., 1947).—Phases α (Ag-rich face-centred cubic), β (ordered body-centred cubic), γ (probably similar to γ -AgCd) and δ (Mg-rich, hexagonal) are found. Graphs of variation of lattice-parameter with composition and representations of powder photographs are given.

A. J. C. W.
548.733 : 545.824
X-ray diffraction photometer. See Abstr. 1555

548.733 : 621.386.1
1564. Two or four windows on X-ray tubes for crystallographic purposes. UNMACK, A. AND JENSEN, A. T. Letter in *J. Sci. Instrum. Phys. Ind.*, **25**, 399 Nov., 1948).—The present trend toward the construction of 2-window sealed X-ray tubes is criticized. Several advantages of the 4-window type are emphasized, particularly that a very fine line focus

gives sharper powder photographs than a somewhat broad point focus.

A. J. C. W.

548.735.4
1565. The correction of X-ray intensities for Lorentz-polarisation and rotation factors. GOLDSCHMIDT, G. H. AND PITT, G. J. *J. Sci. Instrum. Phys. Ind.*, **25**, 397-8 (Nov., 1948).—Describes the construction and use of a scale which gives respectively the Lorentz-polarization factor plotted as a function of the reciprocal spacing, the reciprocal spacing itself and the unitary atomic scattering factor (for CuK radiation only), and from which all these quantities may be determined in a simple fashion from the reciprocal net. Charts are also given for the rapid determination of the rotation factor. J. T.

548.736.15 : 549.211 : 548.1.021
1566. Determination of the crystallographic axes of diamond. VARDHAN, H. *J. Sci. Industr. Res.*, **7B**, 189-93 (Dec., 1948).—A Laue photograph of the diamond is compared with a chart giving 55 standard orientations. A. J. C. W.

MINERALOGY 549

549.1 : 539.16
1567. Uranium and radium content of rock salt and sylvine. KEMÉNY, E. *S.B. Akad. Wiss. Wien*, **150**, *Abt. IIa* (No. 8) 193-207 (1941) In German.—The U- and Ra-content of rock salt samples was determined to find whether the presence of He in the solid mineral is due to electron-capture of α -particles from radioactive inclusions. A mean content of 6×10^{-10} g U per g sample was found. There was no large difference between the various types of mineral salt. In general the amount of He is too large to be produced by the radioactivity of the U and Ra inclusions. Salt mines are useful for investigations of cosmic rays under great absorption, due to their low activity. V. W. R.

549.211 : 548.1.021 : 548.736.15
Determination of the crystallographic axes of diamond. See Abstr. 1566

GEOPHYSICS 55

550.312 : 53.082
1568. Some experimental investigations on the measurement of gravity. LAGERQVIST, P.-A. *Ark. Mat. Astr. Fys.*, **36A**, Paper 12, 25 pp. (1948) In German.—Three principles are described, each suitable for the measurement of gravity differences. (1) The construction and use of a new form of capillary-pparatus; (2) the use of a compound quartz-berylum bifilar suspension which is compensated for temperature-expansion, and (3) a quartz horizontal-endulum, also temperature compensated. W. A. R.

550.34 : 534.2
Rayleigh waves in a solid-elastic infinite medium. See Abstr. 1362

550.38
1569. The radial stability of the geomagnetic ring-current. FERRARO, V. C. A. *Terr. Magn. Atmos.*

Elect., **51**, 547-62 (Dec., 1946).—An exact solution is given of an idealized problem, approximately treated in an earlier paper [Abstr. 1228 (1941)] dealing with the radial stability of a geomagnetic ring, in which the ring is replaced by an electrically neutral uniform cylindrical current-sheet whose axis is parallel to the magnetic axis of the Earth. The conclusions of that paper are substantiated, and though it is shown that the sheet is in reality unstable, the rate at which instability sets in is so slow that the sheet may well be considered to be stable. This rate is, moreover, comparable with the rate of decrease of intense and moderate magnetic storms. A.

550.38 : 551.510.535 : 523.73
Variation of the sun's ultra-violet radiation from ionospheric and geomagnetic observations. See Abstr. 1284

550.38 : 621.317.755

1570. A magnetic compass with cathode-ray sensing element. KLIEVER, W. H. AND SYRDAL, R. R. *Trans. Amer. Inst. Elect. Engrs.*, **66**, 529-34 (1947).—The "Cathotrol" remote-indicating compass is described in which the sensing element is away from magnetic materials, including the engines, particularly in aircraft. A vertical c.r.t. has its beam deflected by the earth's field. This is used by replacing the screen by 4 quadrantal anodes which carry current according to the orientation of the tube. Outputs are taken to a vector resolver and a directional gyro to the indicator. The vector resolver is a potentiometer card carrying a contact arranged to move in a circular arc giving an output $\propto$ sine and cosine of angle. Theory and circuit details are given in full. Experience over long periods has been satisfactory. E. H. W. B.

550.9 : 539.16

1571. The radioactivity of the earth. FESTA, C. AND SANTANGELO, M. *Ann. Geofis.*, **1**, 581-609 (Oct., 1948) *In Italian*.—Part I of a comprehensive review of the various problems presented by the subject and of the methods and instruments used. Data on natural radioactivity are compiled. B. F. K.

550.93

1572. Relative abundance of potassium and argon in the earth's surface materials. POOLE, J. H. J. *Nature, Lond.*, **162**, 775-6 (Nov. 13, 1948).—It is concluded that either the data for the abundance and breakdown of K^{40} are wrong, or that the accepted figure for the age of the earth must be reduced by half. W. A. R.

550.93 : 539.155.2

1573. Lead isotopes and the age of the earth. JEFFREYS, H. *Nature, Lond.*, **162**, 822-3 (Nov. 20, 1948).—Holmes's high value for the age of the earth obtained statistically from Nier's ratios of Pb isotopes is criticized. The variation with time of the scatter of the data is examined. It is concluded that more data would be required to improve on Ahren's figure of 2 100 m.y. for the age of the oldest known rocks. W. A. R.

551.465 : 532.517.4 : 532.72

1574. On the mixing of sea water by turbulence. PROUDMAN, J. *Proc. Roy. Soc. A*, **195**, 300-9 (Dec. 22, 1948).—The theory of diffusion by continuous movements, due to Taylor, is applied to the variations, both in time and space, of the distribution of salinity in the sea. It is assumed that the correlation between certain quantities depending on the turbulence at one instant and other quantities depending on the turbulence at a subsequent instant are zero, if these instants are separated by more than a certain minimum interval of time. Formulae are derived for the distribution of salinity at one time in terms of the distribution at an earlier time, and for the time rate of transport of mass of salt. It is a consequence of these formulae that the coefficients of eddy diffusion, as usually defined, do not, in general, depend only on the state of turbulence, but depend also on the distribution of salinity. In certain simple cases, however, the coefficients of eddy diffusion do depend only on the turbulence. Such a case is provided by the central region of the Irish Sea, and the theory is applied to estimate the mean current through this region. A.

ATMOSPHERE . METEOROLOGY 551.5

551.50 : 551.524

1575. Theory of nocturnal cooling of the surface layer and formation of a surface inversion. REUTER, H. *S.B. Akad. Wiss. Wien*, **155**, Abt. IIa (Nos 7-8) 333-58 (1947) *In German*.—A detailed examination of the theory for cooling at the surface leads to equations for the rate of cooling under selected conditions and for different kinds of surface. Knowing the temperature gradient in the atmosphere at sunset and the observed temperature fall at the surface after a few hours, estimates can be made for the lowest layer for a night of any length of the total cooling at the surface and the height and amount of the inversion. The assumptions are a light wind, little or no cloud and constancy of effective outgoing radiation. Natural condensation or sublimation at the surface can retard the cooling and the values so obtained are upper limits. Examples are given for two nights which show good agreement for observation and theory. R. S. R.

551.506

1576. Helmholtz waves in a linear temperature field with vertical wind shear. SEKERA, Z. *J. Met.*, **5**, 93-102 (June, 1948).—Solberg's theory of waves of short wavelength unaffected by the earth's rotation is extended for a vertical wind shear. Under normal conditions this extension means only an insignificant correction provided the wind velocity $\neq$ the wave velocity. If they are = in a particular level then the theory now presented requires an adiabatic or super-adiabatic temp. gradient in the layer. This theory provides not only the necessary conditions for the existence of billow clouds, but also determines the form of the cellular pattern of such waves in terms of their dependence on the wind shear. Transversal waves—normal to the general motion—and rectangular patterns can exist only with a small wind shear; for larger values of shear they change into longitudinal waves (strips) parallel to the general motion. Observations of billow clouds and the experiments with artificial clouds support the theory. A.

551.508

1577. An airplane psychograph. KATZ, I. *Bull. Amer. Met. Soc.*, **28**, 363-70 (Oct., 1947).—The instrument has ceramic resistors, possessing a large negative temp. coefficient, for its dry and wet bulb elements. They are coated with plastic to overcome leakage due to deposition of hygroscopic particles. Electronic recording is used. The resistors are rapid in response and sensitive enough to measure sharp gradients of temp. and water vapour usually present close to the boundary air/water or air/land. The mounting on an aircraft is illustrated. With a slow climb 7 observations can be made up to 500 ft. An accuracy of $\pm 0.2^\circ\text{F}$ can be obtained. It can also be mounted on balloons for an ascent or when flown at a fixed height. The observations are used in connection with anomalous propagation of u.h.f. radio waves used for radar. R. S. R.

551.508.2 : 551.524.4/7

1578. Control tests on temperature measurement in the stratosphere. FEA, G. *Ann. Geofis.*, **1**, 239-45

(April, 1948) *In Italian*.—A series of soundings was taken up to 15 000 m with American radiosondes fitted with two thermoelements in different settings and with different absorbing powers. The sondes were sent up with very different velocities; the agreement of the registered data seems to indicate that for the given type of sonde, up to the altitude reached, the "trainage" effect observed is negligible and that apart from a clear discontinuity of the temperature gradient between 10 000 and 12 000 m the gradient is practically zero between this altitude and 15 000 m. A.

551.51

1579. Analysis of temperature, pressure and density of the atmosphere extending to extreme altitudes. GRIMMINGER, G. *Rand. Corp. (Santa Monica, Cal.) Monogr. (Nov., 1948) pp. xv + 149.*—A monograph sponsored by the U.S. Air Force in connection with its rocket and earth-satellite programme. Values are given of vertical distribution of temp., pressure and density to heights of > 5 000 miles for various latitudes. Calculations beyond the ionosphere are based on three distinct models. Model I assumes an atmospheric limit in thermal equlim. with the interstellar gas at 10 000°K. Model II assumes that above the F_2 layer the m.f.p. between molecules is so large that they move in free gravitational trajectories. Neglecting radiation, the temp. distribution in this region is isothermal. Model III is similar to II but includes refinements such as variation of composition with height and the existence of diffusion equlim. The report contains 45 tables, 44 graphs and a bibliography of 108 references.

551.51 : 523.5

Meteor research. See Abstr. 1279

551.510.4

1580. Ozone in relation to the state of the atmosphere. NICOLET, M. *Inst. Roy. Met. Belge Misc. (No. 19) 36 pp. (1945) In French.*—A summary of present knowledge—theoretical and observational—relating to atmospheric O_3 with special reference to its vertical distribution and spectral absorption. A useful bibliography is appended. D. R. B.

551.510.535

1581. On a new method for exploring the upper ionosphere. BAILEY, D. K. *Terr. Magn. Atmos. Elect., 53, 41–50 (March, 1948).*—Conditions above the height of maximum ionization of the F_2 -layer are not known. Measurements of the refraction experienced by radio waves arriving at the Earth after passage through the entire ionosphere can yield information about its uppermost regions. An expression for the refraction of waves which pass through a parabolic-layer model is derived, permitting frequencies to be specified within which profitable refraction measurements can be made. Either the Sun, which emits radio "noise," or the Moon, which can be used to return radio waves originating on the Earth, is a suitable extraterrestrial source of waves. An experimental technique for measuring refraction is described and discussed. A.

551.510.535

1582. The production of the E-layer. HOYLE, F. AND BATES, D. R. *Terr. Magn. Atmos. Elect., 53, 51–62 (March, 1948).*—Difficulties in the current theory of the formation of the E-layer are summarized.

Consideration is given to the possibility that it is produced by the high-energy photons thought to be emitted by the solar corona. The energy-distribution needed is investigated, and it is found that it is sufficient that there be a photon-group either at about 325 eV or at about 1 300 eV. However, only the former would give detailed agreement with observation; the latter would not be fully satisfactory owing to the effects of secondary emission in the Earth's atmosphere. The general requirements are consistent with the predictions of solar theory. A.

551.510.535

1583. Temperature and recombination coefficient in the ionosphere. SEATON, S. L. *J. Met., 4, 197–200 (Dec., 1947).*—Methods are developed for evaluating from experimental data the recombination coefficient α between electrons and positive ions throughout the 24 hours in the ionosphere. Values of α so determined are applied to calculation of ionospheric temp. from Thomson's relationship. Adoption of suitable reference temps. and corresponding α 's is discussed. Composite atmospheric temps. at noon are given for equinoctial period at the equator during sunspot minimum. Highest temps. of the order of 600K, are found at the height of 100 km. Noon temps. in the region 200–400 km appear to be of the order of 200K to 250K. A.

551.510.535 : 523.7

1584. Evidence for a solar action on the ionised regions of the upper atmosphere. LEJAY, P., HAUBERT, A. AND DURAND, J. *C.R. Acad. Sci., Paris, 226, 1768–70 (May 31, 1948) In French.*—The day to day and diurnal departures of the normal incidence critical frequency of region F_2 from monthly mean values are considered in relation to the magnetic activity index K. Data from Slough, England, and Washington, U.S.A., for the month of September 1946, are considered. For both stations the usual depression in critical frequency during periods of high magnetic activity is noted. It is also found that often, at each station, there is a pronounced diurnal variation in the magnitudes of the departures with maximum values around midday. It is suggested that the latter fact indicates some quasi-instantaneous changes in solar ionizing radiation. These diurnal variations, with maxima at midday, are sometimes in the opposite sense at Washington and Slough and the different locations of these two stations with respect to the magnetic pole may be the explanation of this fact.

W. J. G. B.

551.510.535 : 523.72 : 523.755

1585. Coronal radiation and ionospheric variations during the solar eclipse, July 9, 1945. WALDMEIER, M. *Terr. Magn. Atmos. Elect., 52, 333–8 (Sept., 1947).*—From ionospheric and coronal observations it is deduced that the source of the solar u.v. light, producing the E-layer, lies in the innermost part of the corona in the regions of highest intensity of the 5 303 Å-radiation. Very strong support to this conclusion is given by the fact that in these regions the temperature of the corona reaches its highest values. A.

551.510.535 : 523.72 : 621.396.11 : 538.566.3

Theory of radio wave interaction. See Abstr. 1502

551.510.535 : 523.746

1586. The ionosphere as a measure of solar activity. PHILLIPS, M. L. *Terr. Magn. Atmos. Elect.*, **52**, 321-32 (Sept., 1947).—Critical frequencies of all regular ionospheric layers vary diurnally, seasonally, with geographic latitude and longitude, and with solar activity. For locations where such trends are well established, observations of critical frequency may be used to determine an ionospheric "sunspot-number." If values of F_2 -layer critical frequency near local noon are used, since these generally have the most pronounced variation with solar activity, the ionospheric "sunspot-number" obtained is considerably closer to its average value than are ordinary sunspot-numbers to their averages. As this measure is practically independent of varying atmospheric conditions and personal variation among observers it probably presents a more precise index of solar activity. A.

551.510.535 : 550.38

1587. Magneto-ionic measurements at high latitudes. SCOTT, J. C. W. *Terr. Magn. Atmos. Elect.*, **53**, 109-22 (June, 1948).—Measurements of F_2 -layer critical frequencies for z -, o - and x -modes at Clyde River, Baffin Land, on the assumption of the law $f_H = 2(f^x - f^o) - (f^x - f^o)^2/f^x$ indicate large diurnal and seasonal variations in the magnetic field. Superimposed on these periodic changes a drop of 20% in apparent field occurred in February 1946, which persisted through September. The variation of gyro-frequency with height is greater than would be expected from the inverse-cube law and the law $f^x - f^z = 2(f^x - f^o) - (f^x - f^o)^2/f^x$ is not confirmed. A.

551.510.535 : 550.38

1588. A model of the ionosphere. WOODWARD, R. H. *Terr. Magn. Atmos. Elect.*, **53**, 1-25 (March, 1948).—Observations and theories of a number of geophysical phenomena associated with the ionosphere are summarized, and a model proposed to provide qualitative interpretations of most of them. In low and intermediate latitudes electrons are assumed to rise; they migrate through the upper ionosphere to the polar region, where they fall and complete the circuit through the ground. Under the action of an electric field, positive ions, formed at great heights by u.v. light, tend to rise, whereas negative ions descend. Since the ions are constrained to helical paths along the sloping magnetic lines of force, positive ions tend to collect in a ring near the plane of the geomagnetic equator; negative ions accumulate in the polar regions. Solar radiation-pressure distorts the ion-ring and blows the tail to a height of several Earth-radii. Electric discharges between the positive ion-ring and the negative polar caps produce magnetic disturbances and the associated auroral displays. A.

551.510.535 : 550.38 : 523.73

Variation of the sun's ultra-violet radiation from ionospheric and geomagnetic observations. See Abstr. 1284

551.510.535 : 621.396.11

1589. Some experimental results obtained by ionospheric investigations in Sweden during the total solar eclipse of July 9, 1945. GEJER, S. AND ÅKERLIND, P. *Terr. Magn. Atmos. Elect.*, **52**, 479-91 (Dec., 1947).—

Determinations of critical frequencies, virtual heights and other measurements are described. Definite effects on the critical frequencies for the different layers were established by means of multifrequency recordings. The decrease in E -layer electronic density from the assumed undisturbed value was about 57%. For the F_1 -layer the corresponding decrease was 63% and for the F_2 -layer approx. 33%. A.

551.510.535 : 621.396.11 : 538.566.3

Trajectories of rays in the ionosphere. See Abstr. 1500

551.510.535 : 621.396.11 : 538.566.3

Anisotropic ionosphere effect. See Abstr. 1501

551.513 : 523.38

1590. On a lunar bi-fortnightly tide in the atmosphere. BRYSON, R. A. *Trans. Amer. Geophys. Un.*, **29**, 473-5 (Aug., 1948).—By studying the latitudinal anomalies of the eastern Pacific anticyclone and the subtropical high-pressure belt, the author shows that corresponding to the equatorward component of the tide-producing force of the Moon there is a similar variation in the parameters mentioned above. A.

551.513.11

1591. Vertical eddy flux of heat in the atmosphere. MONTGOMERY, R. B. *J. Met.*, **5**, 265-74 (Dec., 1948).—The thermodynamics of open systems is developed for a special atmospheric system in order to obtain a precise definition of the vertical eddy flux of heat. The upward eddy flux of heat per unit area is $(\rho V_z' h)$, where ρ is density, V_z' is a specially defined fluctuation of the vertical component of velocity, and h is specific enthalpy. In terms of the eddy diffusivity K , the unit-area flux of sensible heat is $-K \rho d Y_d / dz$, where z is height and $Y_d \equiv c_p T + \phi$ and, in turn, c_p is isobaric specific heat, T is temperature, and ϕ is geopotential. The heat flux, including the latent-heat flux due to the flux of water vapour, is $-K \rho d Y_t / dz$, where $Y_t \equiv c_{pd} T_e + \phi$ and, in turn, c_{pd} is the isobaric specific heat of dry air and T_e is equivalent temperature. Other expressions can replace these general expressions under stated conditions. Under some conditions the rate of loss of heat from the ocean surface by evaporation and conduction to the air, for a given distribution of eddy diffusivity, depends only on the mean surface temperature $\bar{T}_a$ and on the mean wet-bulb temperature $\bar{T}_{wb}$ at a chosen, short distance above. The rate of loss of heat is proportional to the difference in corresponding equivalent temperatures, $\bar{T}_{ea} - \bar{T}_{eb}$. A.

551.52 : 535.242

A photometer for measurement of sky brightness near the sun. See Abstr. 1371

551.521.14 : 535.361.2

1592. The reflection of diffuse radiation by the sea surface. NEIBURGER, M. *Trans. Amer. Geophys. Un.*, **29**, 647-52 (Oct., 1948).—Measurements of the fraction of the solar radiation passing through stratus cloud reflected by the sea surface led to the conclusion that the radiation is not completely diffuse. The average albedo was 0.105 with values varying with cloud thickness and solar elevation. The indication is that for completely diffuse radiation Schmidt's theoretical value of 0.17 would apply. A.

551.524

1593. The magnitude of radiative heating in the lower stratosphere. ODER, F. C. E. *J. Met.*, **5**, 65-7 (April, 1948).—The problem presented is the determination of the order of magnitude of nonadiabatic temperature changes in the lower stratosphere due to radiative processes. Calculations of heat-flux divergence are made on a synthesized model by dividing the atmosphere between 10 and 50 km into layers with assumed uniform temperature and absorber distribution. Results of the calculations, which are made for 3 bands of O_3 in the infrared and for 2 bands of CO_2 in the infrared, indicate that the time rate of change of potential temperature due to radiative processes increases from 10^{-6} (degrees K/sec) in the lower 15 km to 10^{-3} in the layers from 35 to 47 km and decreases to 10^{-5} in the uppermost 3 km. A.

551.524

1594. Upper atmosphere temperatures from remote sound measurements. COX, E. F. *Amer. J. Phys.*, **16**, 465-74 (Dec., 1948).—A survey of the use of abnormal audibility to obtain upper air temps. It shows that the observed data do not conflict with Whipple's theory and discusses the frequency dependence of abnormal sound. The use of V2 rockets to investigate upper air temps. has produced results in agreement with those obtained from abnormal audibility. The author suggests that abnormal sound measurements provide the most suitable means of measuring upper air temps. and that they can yield further information on the ozone absorption of u.v. radiation in the stratosphere. J. M. H.

551.524 : 551.508 : 536.51

1595. Method for measuring air temperature on a high-speed airplane. TERADA, K. AND YAMAMOTO, G. *J. Met.*, **4**, 201-2 (Dec., 1947).—The temperature indicated by thermometers used on aeroplanes is higher than the true air temperature by an amount $\propto$ the square of the air stream speed (u^2). On the other hand, inside a Venturi tube the air is subject to a speed increase which according to Bernoulli's theorem is accompanied by a pressure decrease and, therefore, an adiabatic temperature decrease $\propto u^2$. By installing a thermometer inside a suitably designed Venturi tube these effects are made to compensate each other. Some experiments made flying at 4 000 m indicated an increase of temperature of $0.7^\circ C$ when the aeroplane speed was increased from 250 to 400 km/h. Air compressibility was not considered in the theory, but its effect at current aeroplane speeds is not large. For very fast aeroplanes a Pitot tube should be used, the air temperature being measured at the stagnation point by means of a resistance thermometer. M. D.

551.543

1596. Quantitative analysis of factors influencing pressure change. FLEAGLE, R. G. *J. Met.*, **5**, 281-92 (Dec., 1948).—The contribution to density change made by local compression or expansion, advection and vertical motion, and by horizontal mass divergence or convergence is determined for 132 cases chosen during a period of anticyclogenesis above a polar anticyclone and during two periods of cyclogenesis.

The density change in the layer 2 or 3 kilometers in thickness just above the tropopause is shown to contribute most to pressure change at the ground. This density change may be considered to be the result either of advection in the lower stratosphere or of the excess of horizontal mass divergence over vertical mass divergence. Advection in the lower stratosphere is found to be closely related to local pressure change and to vertical motion in the upper and middle troposphere: downward motion accompanies rising pressure and advection of denser air and upward motion accompanies falling pressure and advection of lighter air. A.

551.543 : 551.515.4

1597. The thunderstorm high. SCHAFFER, W. *Bull. Amer. Met. Soc.*, **28**, 351-5 (Oct., 1947).—Earlier calculations of the pressure rise during a thunderstorm by attributing it to the effects of vertical acceleration are considered invalid because neglected terms, though small, must be considered together with differences of larger terms which may be nearly equal. A method involving tubes of flow is used to obtain an expression for the change of pressure and this leads to results comparable with those observed. It is agreed that the dynamic effect dealt with is not the only cause for the change of pressure, and temp. changes associated with falling rain as well as other causes play a part. R. S. R.

551.55 : 551.513

1598. On the computation of wind from pressure data. NEIBURGER, M., SHERMAN, L., KELLOGG, W. W. AND GUSTAFSON, A. F. *J. Met.*, **5**, 87-92 (June, 1948).—Theoretical expressions for the deviations of the computed from the observed speeds and velocities are derived. These show that the gradient speed is always greater than the true speed. The gradient speed is shown to be a better approximation than the geostrophic for most cases, but for some cases of curved cross-isobaric flow the geostrophic speed is closer to the true speed. A.

551.590.22 : 525.624

1599. The lunar atmospheric tide at twenty-seven stations widely distributed over the globe. CHAPMAN, S. AND TSCHU, K. K. *Proc. Roy. Soc. A*, **195**, 310-23 (Dec., 1948).—Determinations of the lunar atmospheric tide at 27 stations, in America, Africa and other parts of the world, have been made by the Chapman-Miller method from bi-hourly values of the barometric pressure extending, in the aggregate for the 27 stations, over about 500 years. (1) The amplitude c_2 decreases with increasing latitude, though the decrease is not quite regular. (2) The phase angles θ_2 are in the usual quadrant, betokening a lag of high tide after the moon's transit, though the lag itself differs from station to station. (3) At almost all the stations the lunar air-tide undergoes a very appreciable annual change; a reduction in the values of both θ_2 and c_2 occurs in both hemispheres near the December solstice. (4) No very appreciable variation of the air-tide with height has been found up to about 3 350 m. (5) In the U.S.A. the tide has a notable reduction of c_2 on the western coast, but no striking contrast in the case of θ_2 can be noted. (6) Several stations in East Africa, together with Singapore and

Batavia, show results which indicate a specially interesting region where the tide has the biggest amplitude found anywhere on the surface of the earth, and where the phase lag is normal. (7) An asymmetrical distribution of c_2 about the equator in the same continent (Africa) is also very surprising and requires proper interpretation. A.

551.593 : 525.7 : 535.33 : 523.77

New bands in the telluric spectrum. See Abstr. 1288

551.593.62 : 535.6

Colours of rainbows and mist-bows. See Abstr. 1424

551.594.1.08

1600. Influence of the space charge on the response of radioactive sondes. CIALDEA, R., LO SURDO, A. AND ZANOTELLI, G. *Ann. Geofis.*, **1**, 155-63 (April, 1948) *In Italian*.—The influence of the space charge on the potential measurement of a laterally unlimited radioactive sonde is investigated and the theoretical

results are compared with experimental data obtained with a real sonde.

551.594.1.0

1601. Influence of the wind on the performance of radioactive sondes. CIALDEA, R., LO SURDO, A. AND ZANOTELLI, G. *Ann. Geofis.*, **1**, 491-508 (Oct., 1948) *In Italian*.—Results are given of measurements of the potential itself in a uniform field along the lines of which flows an air current; the deviation of the potential from its static value first increases to a maximum with increasing velocity of the wind, and successively decreases asymptotically to zero. A theoretical treatment is then presented allowing the experimental results to be satisfactorily interpreted. There are two distinct phases of the phenomenon according to whether the wind speed $>$ or $<$ the ionic velocity under the action of the field. These two phases correspond to the branches of the curve on which the deviation respectively increases and decreases with increasing wind velocity. B. F. F.

BIOLOGY 57/59

578.088.5 : 537.133 : 539.164.94

On the effective cross-section of protons and α -rays in relation to the radiation-sensitive volume of radiobiological elementary reactions. See Abstr. 1521

591.18

1602. Interaction of cycles. ROBERTS, J. B. *Bull. Math. Biophys.*, **10**, 123-9 (Sept., 1948).—For neural nets a circuit consisting of k cycles is assumed such that one cycle is activated by an outside stimulus and sends an impulse to a second cycle which in its turn sends an impulse to the next cycle, etc., up to the k th cycle, which sends an impulse to a response. A "series" of k cycles thus "interacts." Several theorems are given regarding the response patterns of such circuits under the additional constraint that the stimulus acts but once, and at the time it acts the circuit is at rest. A.

591.18 : 518.5

1603. Cycle distributions in random nets. RAPOPORT, A. *Bull. Math. Biophys.*, **10**, 145-57 (Sept., 1948).—Characteristics of random nets are derived from assumptions concerning the distribution of connections. The single aggregate of neurons with random connections without branching and 2 parallel chains with normal distribution of connections are considered. The cycle saturation is derived for each type of net, that is, the fraction of neurons which are members of cycles. It is shown that in the single aggregate with random connections, the cycle saturation varies inversely as the square root of the number of neurons; in the dense 2-chain net it varies inversely as the square root of the neuron density and inversely as the square root of the standard deviation of the normal distribution. A.

591.185.63 : 538.3

1604. Homing pigeon in electromagnetic fields. CLARK, C. L., PECK, R. A., JR. AND HOLLANDER, W. F. Letter in *J. Appl. Phys.*, **19**, 1183 (Dec., 1948).—Into whatever field the homing pigeon was put, it

showed no concern nor deviation from normal behaviour. W. A. F.

MEDICAL SCIENCE . HUMAN PHYSIOLOGY 61

612.8

1605. An illuminant-stable color vision test. II. Experimental-statistical evaluation. FREEMAN, E. AND ZACCARIA, M. A. *J. Opt. Soc. Amer.*, **38**, 971-8 (Nov., 1948).—Previously the physical specifications and the psychophysical requirements were presented for 6 inks from which an illuminant-stable red-green colour vision test could be constructed. The test of 17 polychromatic plates was prepared and administered to 100 colour blind and 100 normal subjects under illuminants ranging from minus-blue to 14 000°K. The paper reports the results of the evaluation of the test in actual practice. Theoretical expectations have been realized in that the test is illuminant-stable, discriminatory between normal and deficient, properly varied in relative difficulty on individual plates for normals and for colour blinds, yielding scores well distributed in terms of the probability function, and with a minimum of overlapping between normals and colour blinds. A.

612.843.31 : 535.62

1606. The effect of chromatic adaptation on achromaticity. HELSON, H. AND MICHELS, W. C. *J. Opt. Soc. Amer.*, **38**, 1025-32 (Dec., 1948).—The tristimulus values of a small (foveal) spot which appears achromatic to an eye which is adapted to a uniform chromatic background have been found experimentally. Various colours have been used for the background, and a considerable range of luminances has been employed for both the background and the spot. It is found that the chromaticity co-ordinates of the achromatic spot can be predicted

by interpolation between the co-ordinates of a "white point," which is independent of the state of adaptation, and those of the background. An empirical interpolation formula, which expresses the effect of adaptation as a function of the tristimulus values of the background and the achromatic spot, is presented.

A.

613.63 : 537.214

1607. Measurement of space-charge in work-places.

KOLB, J. *S.B. Akad. Wiss. Wien*, **149**, *Abt. IIa* (Nos 9-10) 437-45 (1940) *In German*.—The filter method of Obolensky was used to determine the space charge in workshops of corn and textile mills, printing

works, garages, breweries, joiners, steel mills, mines, quarries, also a school and a cinema. The highest +ve charge was recorded at the coalface in a lignite mine, the highest -ve charge in the weaving shed of a textile mill. The space charge is mainly generated by charging of moving dust particles. The inhalation of unipolar air has biological effects; +vely charged air causes headaches, tiredness, etc., while -vely charged air is invigorating after about half an hour.

V. W. R.

616-073.75 : 621.386.8 : 778.33

Fluoroscopic image brightening by electronic means. See Abstr. 1615

GLASS . CERAMICS 666

666.1 : 535.37

1608. Fabrication of boric acid glass for luminescence studies. KASHA, M. *J. Opt. Soc. Amer.*, **38**, 1068-73 (Dec., 1948).—An extrusion process is described, permitting the fabrication of boric acid glass into strips having dimensions of the order of 10 cm × 1 cm × 0.3 mm. The applications of such material in optical studies of complex organic molecules are outlined.

A.

666.1/2 : 548.73

1609. On the structure of glass. ACKERMANN, I. *Optik*, **3** (Nos 1-2) 47-52 (1948) *In German*.—A discussion of X-ray diffraction results on silica glass,

particularly in relation to the corresponding crystal diagrams. Slight differences in the inter-atomic distances are especially discussed.

G. O. J.

METALLURGY 669

669.018

1610. Binary and ternary interstitial alloys. I. The iron-nitrogen system; the structures of Fe₄N and Fe₂N. II. The iron-carbon-nitrogen system. III. The iron-carbon system: the characterization of a new iron carbide. JACK, K. H. *Proc. Roy. Soc. A*, **195**, 34-61 (Nov., 1948).

PHOTOGRAPHY 77

77.01

1611. The mechanism of latent image formation in a photographic emulsion by mechanical pressure. MATHER, K. B. *J. Opt. Soc. Amer.*, **38**, 1054-64 (Dec., 1948).—An investigation of the effect has been carried out with Ilford Nuclear Research Emulsions which were observed to be especially sensitive to pressure. The experiments described were of two kinds: (1) Photographic plates were placed between smooth steel surfaces in an hydraulic press and pressures in the range 70 to 7 000 kg cm⁻² applied. (2) A scribe was drawn across the surfaces of emulsions under varying conditions of pressure, speed, etc. The results of these experiments suggested that the pressure effect might be explained as a temperature effect, the temperature resulting from heat generated by friction. Such estimates as could be made of the temperature to be expected in individual AgBr grains at the surface of the emulsion under the conditions of experiment indicated temperatures of the order of 100 to 1 000°C. This is in general agreement with such other estimates and measurements of surface temperatures involved in solid friction that have been attempted. The effect of temperature on a AgBr grain has been considered in terms of the Gurney and Mott theory of the latent image. While gross uncertainties exist in the values of the activation energies involved in such a calculation, it at least seems plausible that

temperatures of the order of magnitude expected could produce a permanent latent image.

A.

77.01

1612. Xerography: A new principle of photography and graphic reproduction. SCHAFFERT, R. M. AND OUGHTON, C. D. *J. Opt. Soc. Amer.*, **38**, 991-8 (Dec., 1948).—A new process of graphic reproduction and photography has been developed. The basic process, known as xerography, is dry, direct positive-to-positive, rapid and has a number of potential applications in graphic arts and related fields. As a photographic process, xerography employs a re-usable plate consisting of a thin layer of a photo-conductive material on an electrically conductive base. The plate is sensitized by electrostatic charging immediately before use. After exposure, the image is developed by dusting the plate with a micronized powder. Prints are made by transferring and fixing the powder image to paper or other materials. The plate can be used many times to produce additional images. Xerography also provides a unique and simplified process of graphic reproduction, particularly in printing and duplicating.

A.

77.01 : 535.82

1613. Applications of the photographic pressure effect. MATHER, K. B. *J. Opt. Soc. Amer.*, **38**, 1065-7 (Dec., 1948).—Because of their sensitivity to

mechanical pressure, photographic emulsions will reproduce accurately surface contours pressed against them. This offers a new method for preparing high contrast transparent replicas for microscopy. Some photomicrograms of replicas which have been prepared in this way are reproduced here. The technique may find useful application in the microscopy of metallurgical and other opaque surfaces. A.

771.351 : 535.8

Apochromatic resolving-power camera objective.
See Abstr. 1427

771.534.54

1614. Control of photographic printing: improvement in terminology and further analysis of results. JONES, L. A. AND NELSON, C. N. *J. Opt. Soc. Amer.*, **38**, 897-920 (Nov., 1948).—A study is made of the statistical correlation between the density scales of negatives and the sensitometric exposure scales of photographic papers. A formula relating these two variables is proposed, for use as a guide in photographic printing, whereby the density scale of the negative can be used as a means of choosing the grade of paper to be used in making the print. The suggestions of Sanders regarding statistical methods of analysing the data are discussed. The term *useful exposure scale* is abandoned and the terms *sensitometric exposure scale* and *transition point index* are proposed. It is suggested that the sensitometric exposure scale be adopted as the basis for grading photographic papers and that the new numbers be called scale indices. Reasons are given why the contrast of photographic paper is not suitable as a basis for deriving grade numbers. For specifying the shapes of the $D - \log E$ curves of photographic papers, the method proposed by Morrison is recommended. Data are presented on the frequency of occurrence of the various density scales of amateur negatives. A.

778.33 : 621.386.8

1615. Fluoroscopic image brightening by electronic means. COLTMAN, J. W. *Radiology*, **51**, 359-67 (Sept., 1948).—Improvement in the luminosity of X-ray fluorescent screens would result in decreased exposure times with greater safety from burns and screen examination could then to a large extent replace the more expensive radiography. Hitherto screen examination has been unsatisfactory owing to lack of detail. An apparatus has been developed in which light from an X-ray fluorescent screen excites photo-electrons, which are focused on to a phosphor surface via an electron-optical system, giving an image of increased luminosity. An increase in brightness of 500 has been obtained and this will probably be exceeded with improved apparatus. Future develop-

ments may permit the simultaneous viewing of the image by distant observers. B. J. L.

778.6 : 535.624

1616. Contribution to the mathematical treatment of the subtractive method of colour reproduction. II. The division of a colour defined by its transmission function into its components. HELLMIG, E. *Z. wiss. Photogr.*, **43** (Nos 1-8) 86-101 (1948) *In German*.—It is shown that a colour can be obtained subtractively in an infinite number of ways from n colour components. Of these, $(n - 1)$ can be given arbitrarily. This holds for any colour obtained subtractively from three components; the colour can be divided into components which differ from the original ones. Any one colour can be "divided out" from any other colour by determining three concentrations of component colours. Of particular interest is the dividing out of a neutral from a ternary mixture, since it can be shown that any colour obtained by ternary mixture can be divided into a neutral of maximum density and a binary mixture. W. F. B.

778.6 : 535.624

1617. Contribution to the mathematical treatment of the subtractive method of colour reproduction. III. Numerical correlation between the concentrations of three subtractively mixed dyes and the colour sensation belonging to their transmission function. HELLMIG, E. *Z. wiss. Photogr.*, **43** (Nos 1-8) 101-112 (1948) *In German*.—It is shown how to obtain any given colour by the appropriate concentration of three given components which are mixed subtractively. The problem is solved by the fact that any colour can be divided into a neutral and a binary subtractive mixture of two of the component colours of the system. Thus after splitting off a neutral which corresponds to the brightness factor, all colours which can be obtained by a ternary mixture can be reduced to corresponding binary mixtures, which can be represented in two diagrams rather than by a three-dimensional arrangement. These diagrams also enable the converse problem to be solved, which is to find the colour belonging to any subtractive mixture of a given system of dyes. The diagrams belonging to the system of Agfacolor-positive dyes are reproduced. W. F. B.

778.6 : 773

1618. On a new class of developing substances. KUMETAT, K. *Z. wiss. Photogr.*, **43** (Nos 1-8) 113-19 (1948) *In German*.—New developers are described in which a pyridine ring compound is substituted for a H-atom in the hydroquinone nucleus. Their photographic properties are summarized; and their use, in conjunction with certain coupling reagents, to form colour-images, is indicated. D. R. B.